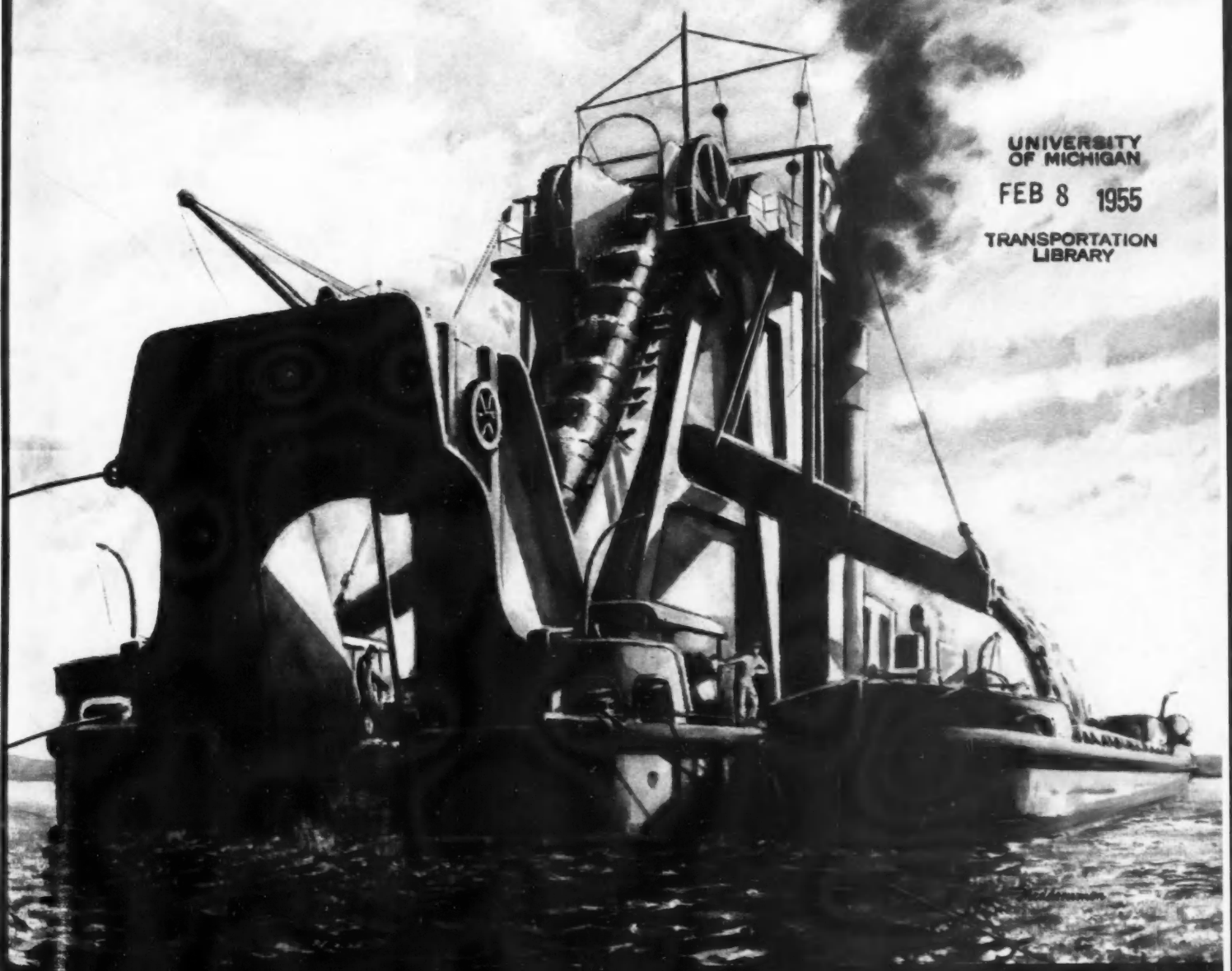
FEB 11 '55

The Dock & Harbour Authority

No. 411. Vol. XXXV. JANUARY, 1955 Monthly 2s. 0d.



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The hopper capacity for each machine is 150 tons.

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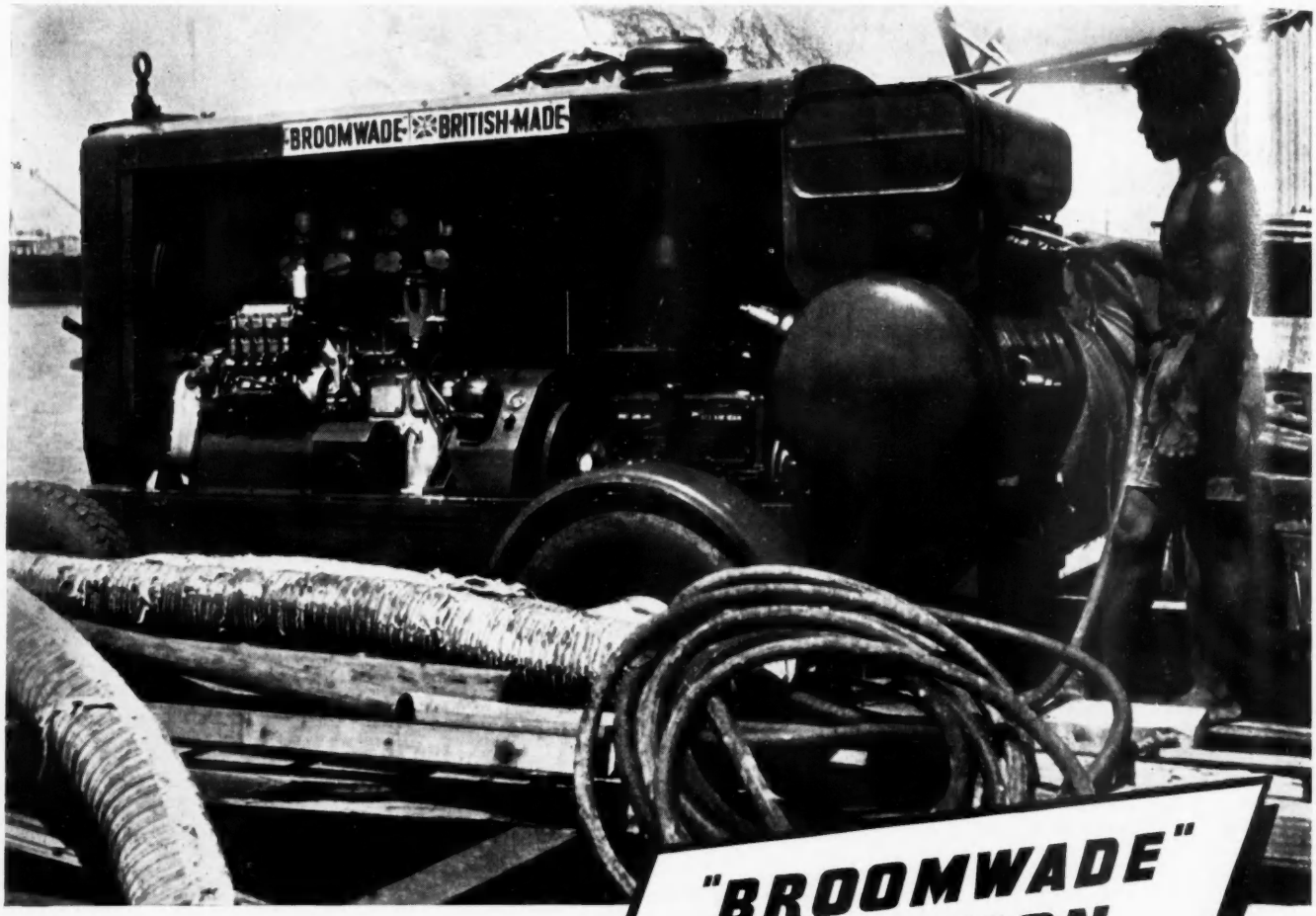

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This "BROOMWADE" SV.199 air-compressor powered by a Gardner diesel engine, is operating from a barge for the Colombo Port Commission.

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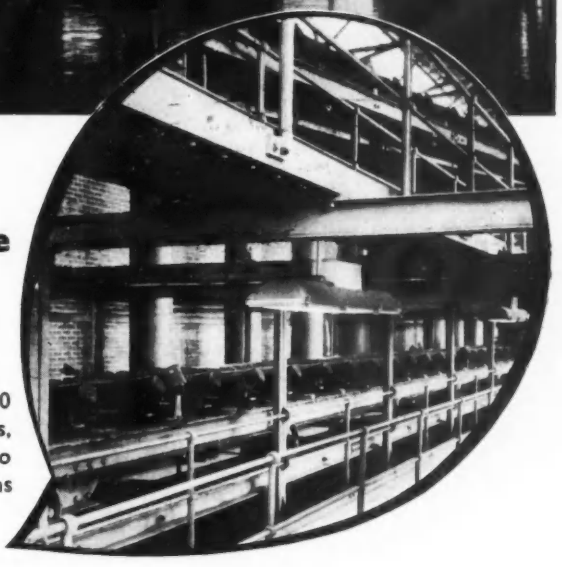

at the new Portslade works of The South Eastern Gas Board

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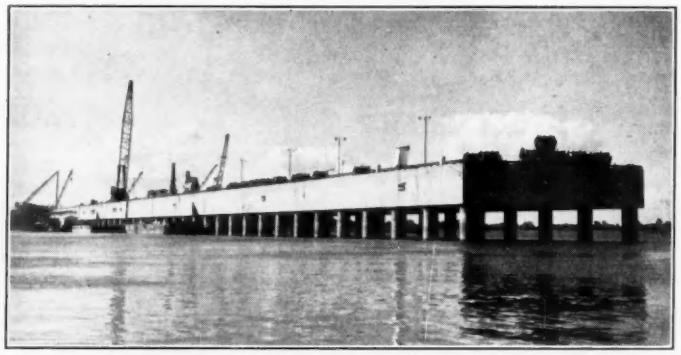
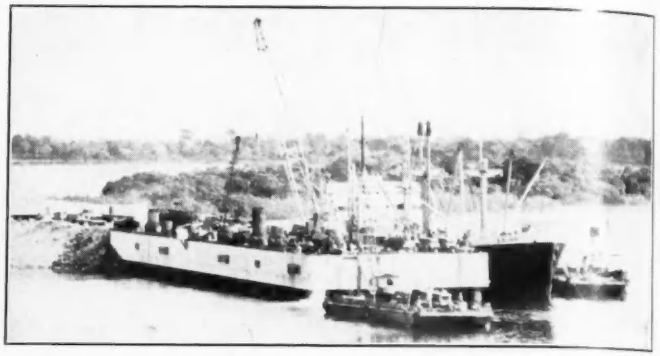
1. *Orinoco Mining Company's new ore and cargo handling dock on the Orinoco River, Venezuela. Composed of 3 units, this DeLong dock is 1,130 ft. long, 82 ft. wide, and 15 ft. deep.*

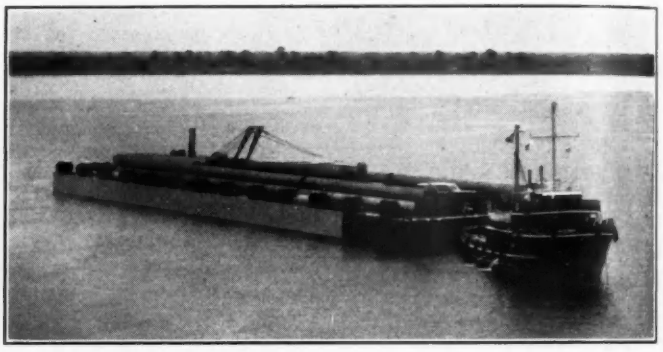


2. *A week after arrival at Orinoco River site, first dock section [illegible] ft. long berths ship, and unloading begins. Two additional units make this pier 1,130 ft. long.*



DeLong airjack transforms sea going dock-barge into ore and cargo pier !

3. *Dock sections were economically fabricated at an Orange, Texas shipyard where costs were carefully controlled. Then, dock barge was launched for towing to pier site.*



4. *Loaded dock section arriving at site on Orinoco River, Venezuela, after being towed across 3,000 miles of ocean. Dock carried caissons, crane, Airjacks, compressors, generators, and all other installation gear.*

Cuts time, costs ! Field work is practically eliminated in dock construction, due to the development of the patented DeLong Airjack. This new technique of dock construction speeds installation, cuts cost.

The DeLong Airjacks, which are the key to the whole transformation of barge to pier, enable the dock to 'climb' the steel columns, or caissons, to required elevation. After the self-lifting operation, caissons are driven to refusal for permanent installations. Caissons are welded to deck and cut off flush ; then filled with concrete or sand and tops closed with welded cover plate.

More than ½ million sq. ft. of the DeLong type of pier are in use or under construction in diversified locations that range from the Arctic to South America.

The DeLong Airjack can cut time and costs in the construction of offshore oil well drilling platforms, portable and permanent piers, and many other types of installations. A DeLong dock can be erected and, after having served its purpose, jacked back to water level and towed to a new location.

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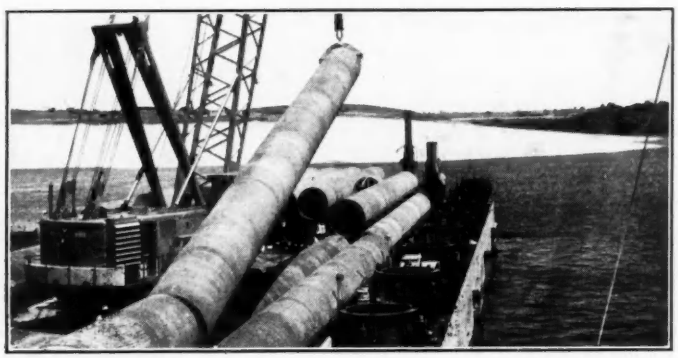
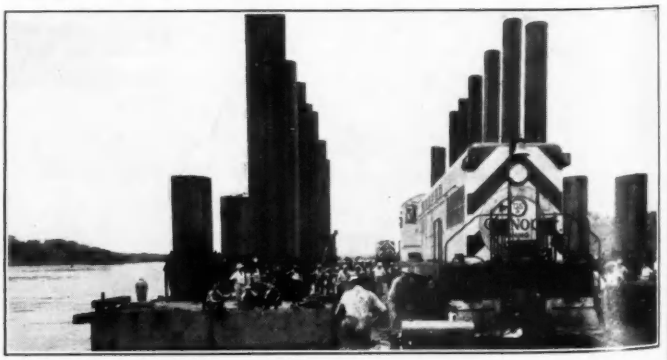
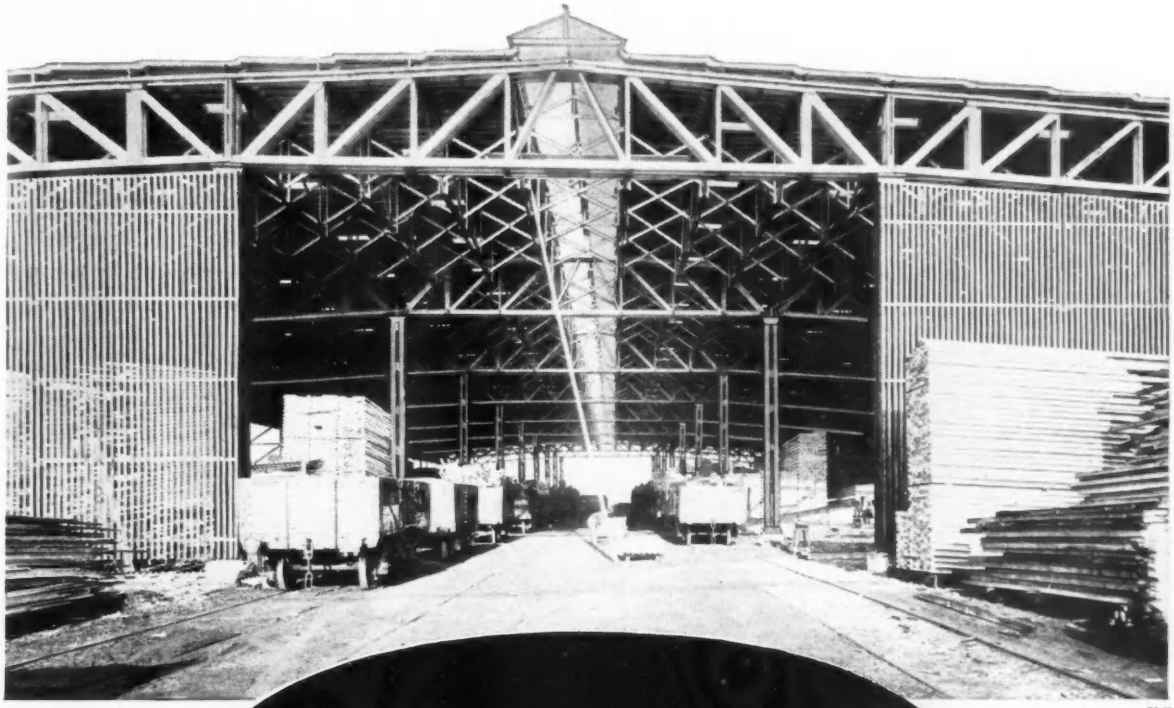
5. *Crane placing 6 ft. diam., 100 ft. long steel caissons in wells fitted with Airjacks. Crane, Airjacks and other equipment were later transferred to second and third sections for erection purposes.*



6. *Caissons held in position by Airjacks until dock barge is jockeyed into final position. Caissons are then dropped to river bottom and DeLong Airjacks lift dock to final elevation. Control is so precise, height of dock can be regulated to 1/32 of an inch.*





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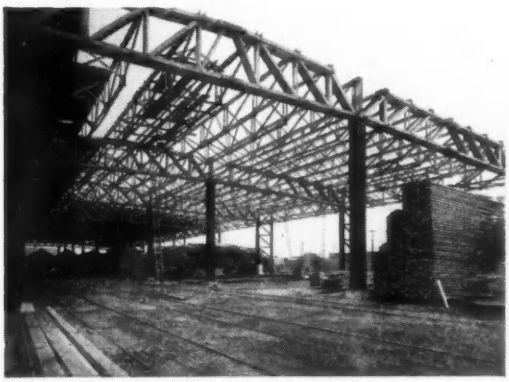

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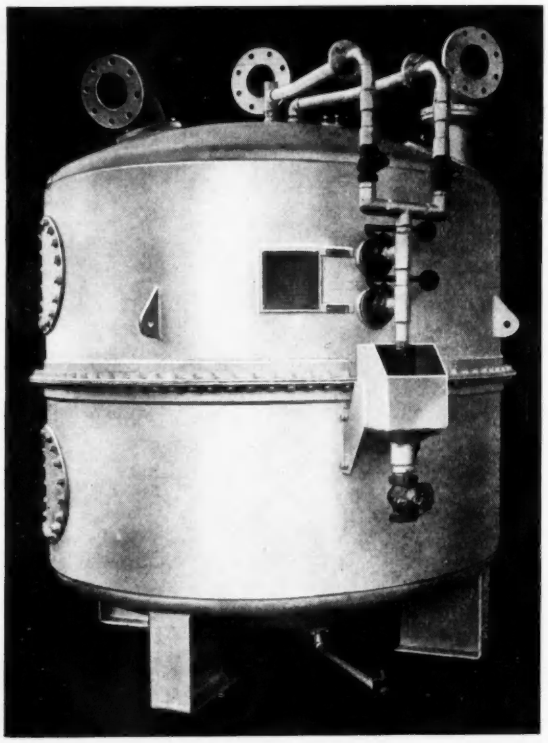

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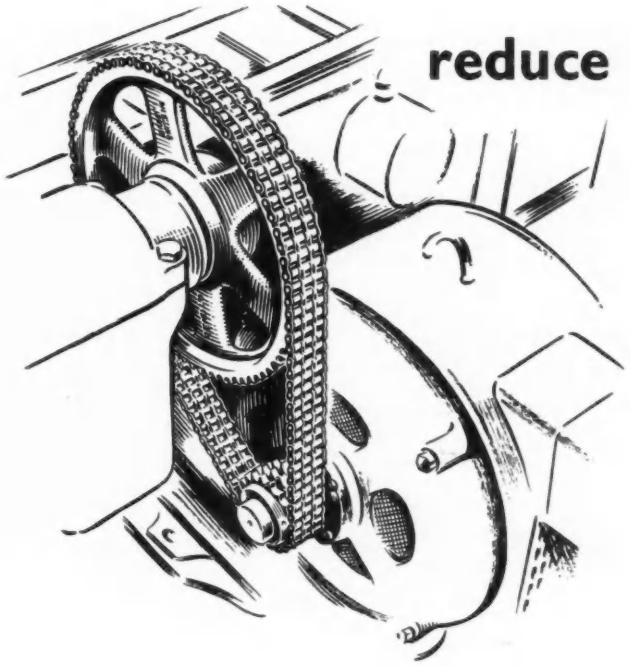

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Note the special portal construction giving a minimum of interference with dockside traffic.

Many new ideas are being developed to meet modern demands for quicker turn round. We are willing, anxious and well equipped to help.

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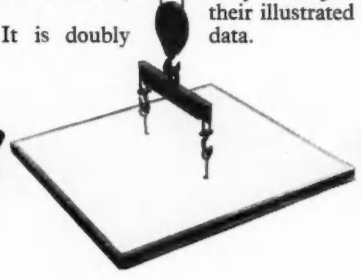
We solved it by laying the floor first—Stelcon steel-clad Rafts, the finest heavy duty floor I've struck in a lifetime of experience.
The whole operation was dead easy. We just laid a bed of sand 4" deep, evenly compacted over level topsoil; brought in our rafts and lowered them into position by mobile crane. And there was our floor, ready for immediate traffic.
Each raft weighs about one ton. It is doubly reinforced, bound with angle iron, and faced with the Stelcon steel-clad wearing surface.
We found that by laying the floor first, the remaining building work was speeded up; saving us 7% in overall cost.
What interests me, is that Stelcon Raft Floors have been in service for 18 years, without costing a penny in maintenance. That's quite a consideration.
Why don't *you* get in touch with Stelcon; ask for their illustrated booklet, it contains all the technical data.



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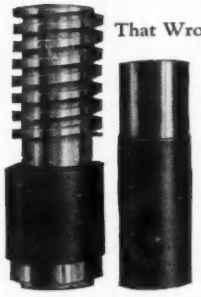

That Wrought Iron has outstanding machining properties is strikingly demonstrated by these typical test pieces. Its ductility is equally notable, while its essentially fibrous character gives it a toughness which enables it to stand up to severe vibrations, absorb varying stresses and recover from sudden shock.

Unrivalled in its ability to withstand shock and overstrain, Wrought Iron is renowned for its rust-resisting properties. Its natural susceptibility to welding is enhanced by slag inclusions; it is safer and more economical than mild steel for many long-term purposes — especially out-of-doors or under wet conditions.

Wrought Iron in strips and bars and in a variety of sections is produced at the Midland Iron Works for innumerable uses. A free copy of our Section Book will be sent on request, while our technical representative will be glad to advise you on any aspect of Wrought Iron usage.

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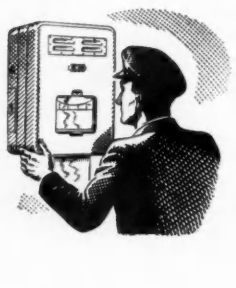
MI/9

See that shoal by No. 3 Buoy!

That's getting serious. There'll barely be two fathoms there at low tide—means a dredging job.

I quite agree.

Amazing how these charts show up the changes to the channel. Kelvin Hughes did the survey, didn't they?



That's right—Contract Survey they call it. Their Surveyors have certainly done a thorough job with their special equipment.

We'd better get them to survey again after dredging, then we'll have up-to-date charts.

Yes, and periodic surveys in the future so we can keep an eye on the channel.

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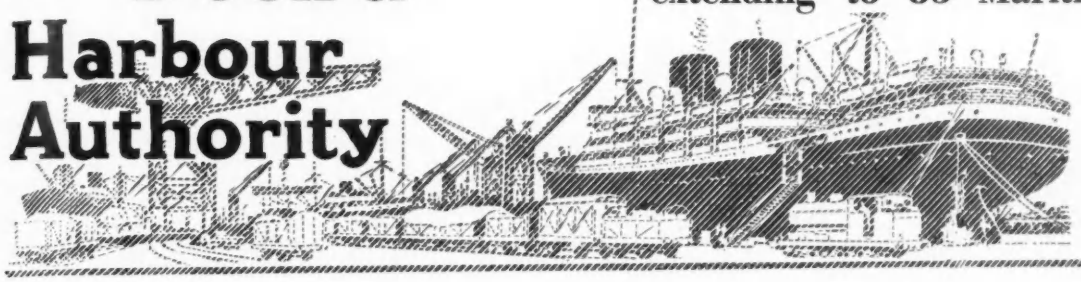


No. 411

Vol. XXXV.

JANUARY, 1955

Monthly 2s. 0d.

Editorial Comments

The Port of Seattle.

Situated on Puget Sound, the largest land-locked body of water in the United States, Seattle has an abundantly sheltered harbour. This safe and natural gateway has no less than 200 miles of water frontage, and is capable of accommodating all the navies of the world. The connecting channel with the Pacific Ocean, the Straits of Juan de Fuca, is also a wonderful stretch of water, averaging from twelve to fifteen miles wide, with a minimum depth of 136-ft. of water, so that the largest vessels afloat can make port and find berthage without the aid of a pilot or tow. The fact that Seattle is the only major port in the United States in which no dredging has to be done for ship channels is also an asset of considerable importance.

Besides the main salt water harbour there is an inland harbour comprising the two fresh water lakes, Washington and Union, which are connected with Puget Sound by the Lake Washington Canal. Ships of 800-ft. can enter the locks of this canal, passing from salt to fresh water in from five to twenty minutes, depending upon their size. In the fresh water of the lakes, wharves may be maintained secure from destruction by marine wood borers; vessels are automatically cleaned of their accumulations of barnacles by contact with the fresh water, and there are no tides—important assets in promoting foreign and domestic trade.

Less than 70 years ago Seattle was a struggling frontier settlement of 4,000 people. To-day, it is one of the chief American ports, and a thriving progressive city of over 460,000 inhabitants. Among the factors which have contributed to this phenomenal growth were the opening of the Panama Canal, the development of United States trade with the Far East, and the economic and strategic importance of Alaska. The sea-borne trade with Alaska commenced in 1897; the opening of the Panama Canal led to the Washington State Legislature authorising the establishment of the Port of Seattle as a municipal corporation in 1911, and the development of Alaska has led to the establishment of all-the-year-round services by an ice-free in-shore shipping route. The shortest sea route to the Far East from the United States is via Seattle which is only 4,276 nautical miles from Japan via the Great Circle Route to the north-westward.

Apart from its commercial shipping traffic, Seattle is a large and important fishing port, and in Salmon Bay there is accommodation for more than 1,000 fishing boats. The port is also the location of Foreign Trade Zone No. 5, and in recent years a large airport has been provided which is now dealing with approximately one million passengers a year.

An account of the early history of Seattle and its development as a port is given in an article in this issue, together with some details of the various facilities available. The Seattle Port Commission is looking forward to the day when trade between the United States and the Far East will be less restricted, and with this in mind is pursuing a vigorous development policy with representation in Latin America, Europe and Africa as well as in the Far East where their agents are at present busy re-establishing pre-war connections.

New Port Labour Plan for Rotterdam.

A new plan, aimed at reducing the present shortage of labour by a more efficient use of the workers available, has been agreed in Rotterdam.

The Haven Arbeids Reserve (Harbour Labour Reserve) which has been in existence since 1916 is to be abolished and every dock worker in the port will, in future, come under the Scheepvaart Vereeniging Zuid. The alteration will, it is expected, give more stability to port work and aid labour relations. A new institution, Centrale voor Arbeidsvoorziening (Labour Supply Office) has been set up and an advisory committee of employers and dockers will discuss any points arising from labour contracts, and representatives of both sides under a neutral chairman will arbitrate on disputes.

The co-ordination of all dock workers under a single body should facilitate holiday schemes and pay regulations. From the point of view of employers the new system should minimise delays in loading and discharging ships, as dockers will be directed to jobs where they are needed with little loss of time. At the outset the scheme may show deficiencies, but these should be remedied through the channels for consultation, and the value of directing complete teams of dockers is considered to be important, as each docker feels attached to his team rather than to an employer.

About 5,800 men will come under the scheme. That number is not sufficient to run the port with full efficiency, but, as in other industries, there is a shortage of labour, probably of 1,000 dockers.

In the past it has been considered a serious disadvantage that the Harbour Labour Reserve lacked the authority to direct men to assigned work. The new scheme is therefore an important innovation which should result in faster port working.

B.T.C. Docks and Waterways.

Following the British Transport Commission's decision to create separate Management Boards for Docks and Inland Waterways with effect from January 1st, a Docks Management Board has now been set up. As already announced, Sir Robert Letch will be Chairman and General Manager of the Docks Division. The other members of the Board will be: Mr. John Donovan, C.B.E., Chief Labour Officer of the Docks Division, Mr. R. P. Biddle, C.B.E., Docks and Marine Manager, Southampton Docks, and Mr. A. E. H. Brown, Chief Docks Manager, South Wales Docks.

With regard to the British Transport Waterways, Sir H. Reginald Kerr, K.B.E., C.B., M.C., has now been appointed Chairman and General Manager. Sir Reginald Kerr has been Divisional Manager of the Midland Division of British Road Services since September, 1948. Other appointments to that Board have yet to be announced.

The decision to separate the management of the Docks from that of the Waterways was commented upon in our last issue, when the need for a definite policy concerning the canals and inland waterways was emphasised. The report of the Board of Survey, appointed some months ago to make recommendations to this end is still awaited, and it is to be hoped that publication will not be long delayed.

Editorial Comments—continued

Dredger Control by Radio.

One of the largest single items of regularly recurring expense at many British ports is the heavy cost of dredging the entrance channels and docks in order to keep available the depth of water necessary to deal with modern shipping. In this respect, the South Wales Group of Ports, which comprises Newport, Cardiff, Penarth, Barry, Port Talbot and Swansea, on the northern shore of the Bristol Channel, is no exception, and a large fleet of dredging and servicing craft are regularly employed on this work. Although the craft normally work within the limits of the particular ports, they are inter-changeable and are allocated as dictated by circumstances. Even when working within the environs of a particular port, however, they are often several miles away from their shore-based control point, hence the problem of easy communication is one which has a large bearing upon the efficiency of their operation.

It was therefore decided by the South Wales docks authorities to look into the possibility of controlling the work by radio, and after investigating several types of installation, it was decided to instal the system chosen on each of the five main bucket dredgers, at two shore-based stations, and in a mobile station which could provide an inter-connecting link when vessels are likely to be beyond the ready range of the shore stations, such as when being transferred from the easternmost to the westernmost ports. This system was introduced last month, and has already shown some of the advantages to be gained from the innovation.

The five dredgers are fitted with transceivers powered from car type batteries with facilities for charging from the vessel's own D.C. mains supply. Transceivers fitted in shore stations have a device for emitting a calling signal to attract attention on the dredgers, where during operation the noise level is very high. This signal is received on a loudspeaker fitted adjacent to the control position on deck in each dredger.

The base station aerials are installed on the roof of the head office at Cardiff and also on the roof of the harbour offices at Swansea, from which office local dredging staff operate.

As far as is known, this is the first occasion when a Port Authority has investigated the possibility of controlling its dredging operations in such a manner, and the experiment will no doubt be watched with interest.

Further Damage to Holland's Sea Defences.

Although less severe than the catastrophic floods of 1953, the recent storms in Europe have again caused further serious damage to Holland's sea defences.

On Texel Island, the gales swept away dunes to a depth of 40 yards and brought the lighthouse to within about 50 yards of the beach. Only three years ago the distance was 130 yards.

The district which has suffered most severely is at Biesbosch in north-west Brabant, where, during the heights of the gales, four-fifths of the land was flooded and many of the inhabitants had to be evacuated. In this area, more than 50 breaches have been made in the dykes surrounding ten privately owned polders, thereby giving free play to ebb and flood tides. Some of the breaches are as much as 60 metres wide and it is estimated that, exclusive of damage to houses and farmland, the costs of repairs will amount to at least 6 million guilders. This figure is higher than the cost of restoring the same area after the 1953 floods, and agricultural organisations in the district have appealed to the Netherlands Government for financial assistance.

Fortunately there were no casualties, largely due to the improved safety measures instituted by the Government immediately following the 1953 flooding.

Topical Notes

Northern Ireland Harbour Schemes.

According to figures issued by the Northern Ireland Government, grants to harbour schemes at Londonderry, Larne, Newry, Coleraine, Kilkeel and Portavogie total £155,000. The estimated costs of the schemes in progress are: Portavogie £220,000; Kilkeel, £189,000; Newry, £88,000; Coleraine, £33,000.

At Larne the extension of the harbour is being undertaken by Larne Harbour Ltd., to whom the Ministry of Finance are paying grants, subject to a maximum of £100,000. It is stated that the Ministry have promised to consider further grants towards the cost of a new quay and reconstruction of the mail steamer berth at Larne, on completion of the work on the south pier. The additional work is estimated to cost £115,000.

The 400-ft. extension to Queen's Quay, Londonderry, part of the Harbour Commissioners' £250,000 improvement scheme is expected to be completed in the spring. A transit shed 300-ft. long is also under construction. When this work has been completed, the removal of 450-ft. of the adjoining wooden wharf and its reconstruction in ferro-concrete will begin.

Accidents in U.K. Docks and Shipyards.

The annual report for 1953 of the Chief Inspector of Factories (H.M.S.O. price 6s. 6d.) reviews the effect of the increase in civil employment and shows that the accident rate in the United Kingdom was a little higher throughout industry generally.

The report contains a breakdown of accident figures in groups of industries including shipbuilding and dock working. Accidents occurring in the shipbuilding industry are detailed in the appendices to the report. In 1953 there were 39 fatal and 8,560 non-fatal accidents reported in this industry, against 55 fatal and 8,164 non-fatal in the previous year. By comparison, the figures for 1939 were 84 fatal and 9,342 non-fatal accidents.

In a chapter dealing with accident prevention organisation, the report refers to the valuable work still being carried out by shipyard safety officers at Glasgow, and on the Tyne, Wear and Tees. The pre-war port safety committee at Liverpool has been reconstituted, and a considerable number of meetings held, and a new committee has been established at Grimsby, with collaboration from the National Dock Labour Board, for whose workers the committee is mainly concerned. At Plymouth docks, an accident prevention committee has been formed and regular meetings held under the chairmanship of the district manager of a shipping company using the port.

In a section on first-aid training, the progress made by the National Dock Labour Board in providing medical centres at various docks, in training of dockers in first-aid, and in encouraging inter-port ambulance competitions, was the subject of favourable comment.

The total number of accidents occurring in docks was 6,111 in 1953, of which 46 were fatal, compared with 54 fatal, and 5,918 non-fatal in the previous year. An analysis of the causes of the accidents shows that handling goods is still much the largest cause of accidents, and the report suggests this would appear to justify more mechanical handling.

Electrical accidents and fires and explosions are given in some detail, and in the case of the latter, application of heat by welding or cutting torches to ships in contact with inflammable liquid are stated to be a prime cause of accidents arising from explosions. More than 100 accidents involving these instruments are notified annually.

Increased Wages for U.K. Dockers.

Increases in the guaranteed minimum wage (fall back rate) and attendance money at present paid to United Kingdom dock workers were announced recently. A top-grade docker will receive an increase of 16s. 6d. on the present guaranteed minimum weekly wage of £4 8s. with proportionate increases for category workers, and for each turn the rate of attendance money payable will be increased by 1s. from the present rate of 5s. per turn.

The proposals for increases were agreed some time previously by the National Joint Council for the Port Transport Industry, and the new rates were accepted at a national dock delegate conference held early this month in London.

The offer to increase the fall back rate to £5 4s. 6d. and the attendance money to 66s. per week (that is, 6s. per turn, payable when men are available for employment but there is no work for them), was accepted by 77 votes to one. The fall back rate is the amount paid to able-bodied men who, while holding themselves available for work, find themselves unemployed when there is no work to offer them.

The Port of Seattle

Its Beginnings, Development and Future Prospects

By E. E. SIMONDS

AMONG the covered-wagon pioneers who travelled to the north-west of the United States was a group which sailed from Portland, Oregon, to a point of land on the sound which they named Alki Point. A year after their arrival, in 1851, they came to the conclusion that the site showed little promise for the development of a port or a town, so they set out in canoes to seek a better place. After taking soundings with rope and rock they finally selected the site which to-day is the flourishing Port of Seattle.

The first commercial shipping on record was in the winter of 1851-52 when the brig "Lanora" loaded piling for San Francisco. Historians have divided Seattle's early commerce into four periods: first, a period of squared timber and piling, 1850-54; second, a period of sawn timber and lumber, 1853-63; third, a period of coal, beginning in 1864; and fourth, grain export and general commerce, beginning in 1888. But the most spectacular shipment was on 17th July, 1897, when the "Portland" arrived from Alaska with one ton of gold from Klondike valued at one million dollars. Seattle soon became the headquarters for Alaska outfitting and it was not long before every steamship operating on the coast included Seattle as a port of call. By 1901 no less than 80 ships cleared Seattle for the north and the port had supplanted San Francisco as a centre of supply for Alaska.

Visualising the effect that the opening of the Panama Canal could have on Seattle as a port, the Washington State Legislature in 1911 passed the Port District Law which authorised the creation of the Port of Seattle as a municipal corporation.

The Port of Seattle Commission took cognizance of the fact that the opening of the Panama Canal, together with Seattle's strategic position on the Great Circle Routes, would grant Seattle access to world trade and cause vital changes in its trade patterns. The Commission knew it would have to be ready with facilities to service the vessels and tonnages that would come, and this realisation led to the Commission launching a five-million-dollar port development programme.

In 1911 the Port Commission planned and obtained finance for construction of five new piers. Later the Port built the harbour's first large facility for ocean-going vessels—the Smith Cove Terminal made up of two piers. These centre-filled piers, 2,640-ft. long and 360-ft. wide, are the largest of their type in the world. They are being used at the present time by the U.S. Navy.

In the years following this first construction programme the Port of Seattle Commission has gradually purchased or constructed such other facilities as the East Waterway Terminal on Harbour Island, the Spokane Street Cold Storage Terminal, the Hanford Street Grain Terminal, Foreign Trade Zone No. 5, and Fishermen's Terminal at Salmon Bay. In addition the Port owns and operates the Seattle-Tacoma International Airport.

The Port Commission

The Port of Seattle is independent of all city, county, or state bodies or agencies. Voters within the Port District, which is the same as King County, elect three Port Commissioners to six-year terms, and they as a Commission direct the Port's affairs.

By its very nature, the Port of Seattle must be and is a constant advocate of waterfront progress. Expansion and modernisation programmes follow a comprehensive plan of harbour improvement prepared by the Port Commission and adopted by the people of the Port District. Money for waterfront construction is obtained from bond issues, and interest and funds for redemption of these bonds are secured by taxation of Port District property.

Basically, and in direct accordance with the regulations under which it was set up as a Port District in 1911, the Port of Seattle is not in the shipping business. It does not operate vessels or participate in the trading of goods. Its business responsibility is to see that docks and facilities are provided for the accommodation of ships and cargoes brought to the port by others.

In addition, the Port Commission recognises that it has a responsibility to do everything it can to help promote shipping or any other form of trade or transportation activity which is in the public interest.

Traffic Returns

The total number of arrivals and sailings in 1953 was 3,875, an increase of 82 over the total for 1952. It is estimated that each ship arrival in the harbour is worth $9,000 to Seattle in the form of ship's payrolls, cartage, ship repairs, supplies, and fuel. These figures do not include military movements, which would raise the total substantially. The piers now operated by the Army and Navy were purchased and developed by the Port of Seattle.

The improvement in the Port's business is a healthy sign that its present programmes are being conducted in a way that will produce valuable business for the city and added income for the actual, tax-paying owners of the Port.

Trade with the Orient and Alaska

Eventual world peace may see the Port of Seattle as the leading gateway to and from the vast areas and markets of the Pacific rim. The Port enjoys an extremely favourable geographical advantage because it is, by two days' sailing time, the closest American port to the Orient. Its destiny has been linked historically with the political, social and economic fluctuations of the Orient and Alaska. Commerce with the Orient vanished

Bell Street Terminal, Pier 66, headquarters of the Port of Seattle. The administrative offices of the Port Commission are on the upper floors, while the lower levels are used for general cargo warehouses offices for private firms and workshops for a ship repair company.

Port of Seattle—continued

with the war, and the Port is now making vigorous efforts toward re-gaining its profitable pre-war trade with the Orient, particularly Japan. Prior to World War II, business with Japan amounted to approximately 24 per cent. of Seattle's total import traffic. This figure is now about 10 per cent.

In 1951 the Port played a leading part in staging the highly successful Japanese Trade Fair in Seattle, the first fair of its type ever held in the United States. Business resulted almost immediately, and Seattle enjoyed a recognition in Japan never before given to an American city.

In 1952, the Japanese Trade Fair of the previous year was expanded to include Pacific rim nations, and was known as the Far East International Trade Fair. Again, the Port of Seattle was one of the principal supporters of the Fair.

Pier 42, owned by the Port of Seattle and leased to the Alaska Steamship Company. This pier is one of the most modern installations in Seattle harbour.

Realising that business is not going to come to those who merely sit back and wish for it, the Port of Seattle Commission in February, 1952, sent two executives — Col. Warren D. Lamport, Managing Director, and John M. Haydon, at that time Director of Public Relations—on a two-month trade solicitation and port promotion tour to Japan, Formosa, Hong Kong, Burma, Thailand, Malaya, the Philippines, and Hawaii. The two Port representatives discussed trade and shipping problems with manufacturers, export agents, exporters, government and trade officials, and others in all the areas they visited.

Representation at Home and Abroad

In December of 1952 the Port of Seattle Commission took an unprecedented step in its programme of trade solicitation. It engaged the services of D. C. Andrews & Company of Chicago, one of the largest and oldest freight-forwarding firms in the United States, and thus became what is believed to be the first United States port to establish such a relationship for the purpose of soliciting traffic.

D. C. Andrews & Company is at present reactivating pre-war connections in the Far East to rebuild traffic movement between the Pacific Coast of the United States and the Orient. Its headquarters will be located in Japan, from where business will be solicited to and from Japan, Formosa, Thailand, French Indo China, the Philippines, Indonesia, Malayasia, North Borneo, Sarawak, India, Pakistan, Assam and Burma, and China at such a time as conditions warrant.

The Port Commission has had under consideration the establishment of a Chicago office. With this new move, however, the Port will not only have representation in the Chicago area but throughout the entire Far East. And inasmuch as D. C. Andrews & Company maintains offices in the principal cities of Latin America and Europe and agencies in Africa, the Port will virtually have global representation.

Likewise, since Seattle has such close economic ties with Alaska, the Port of Seattle has been considering for some time representation in Alaska.

Accommodation for Fishing Fleet

To attract business the Port of Seattle has to offer services to shippers that are better than services offered by competing ports. This calls for modernising present facilities on the waterfront, or the construction of new modern facilities which will meet the demands of to-day's commerce. Most of Seattle's central waterfront facilities were built at about the same time, and were designed to meet the needs of sailing vessels and small steamships. Thus they have reached or are approaching obsolescence almost as a group.

Notable progress was made in 1952 toward effecting the necessary improvements, new facilities being constructed and present ones improved and modernised. The most outstanding development in 1952 was the completion of the million-dollar expansion and modernisation programme at Fishermen's Terminal at Salmon Bay, which has made it one of the finest commercial fishing terminals in existence. The Terminal now has a peak moorage capacity of 1,000 fishing vessels, and has complete drydocking, painting, repair and maintenance facilities. Located at the Terminal are commercial marine business firms supplying all forms of ships' stores, engines, fuel, fishing gear and other marine supplies and services.

The development of the Terminal began in 1912, when the Port acquired the property. During World War I it was a valuable site for ship building. Its worth lies in its ability to serve as a headquarters for an industry which contributes millions of dollars in capital investment, taxes, and purchasing power each year.

The focal point of the new Terminal is the $275,000 office and restaurant building which faces the fishing fleet at its moorage. The restaurant and cocktail lounge in the building are among the most unique and colourful in the city. Patrons are provided with spectacular marine views through the large windows looking directly out over the docks and fishing fleets.

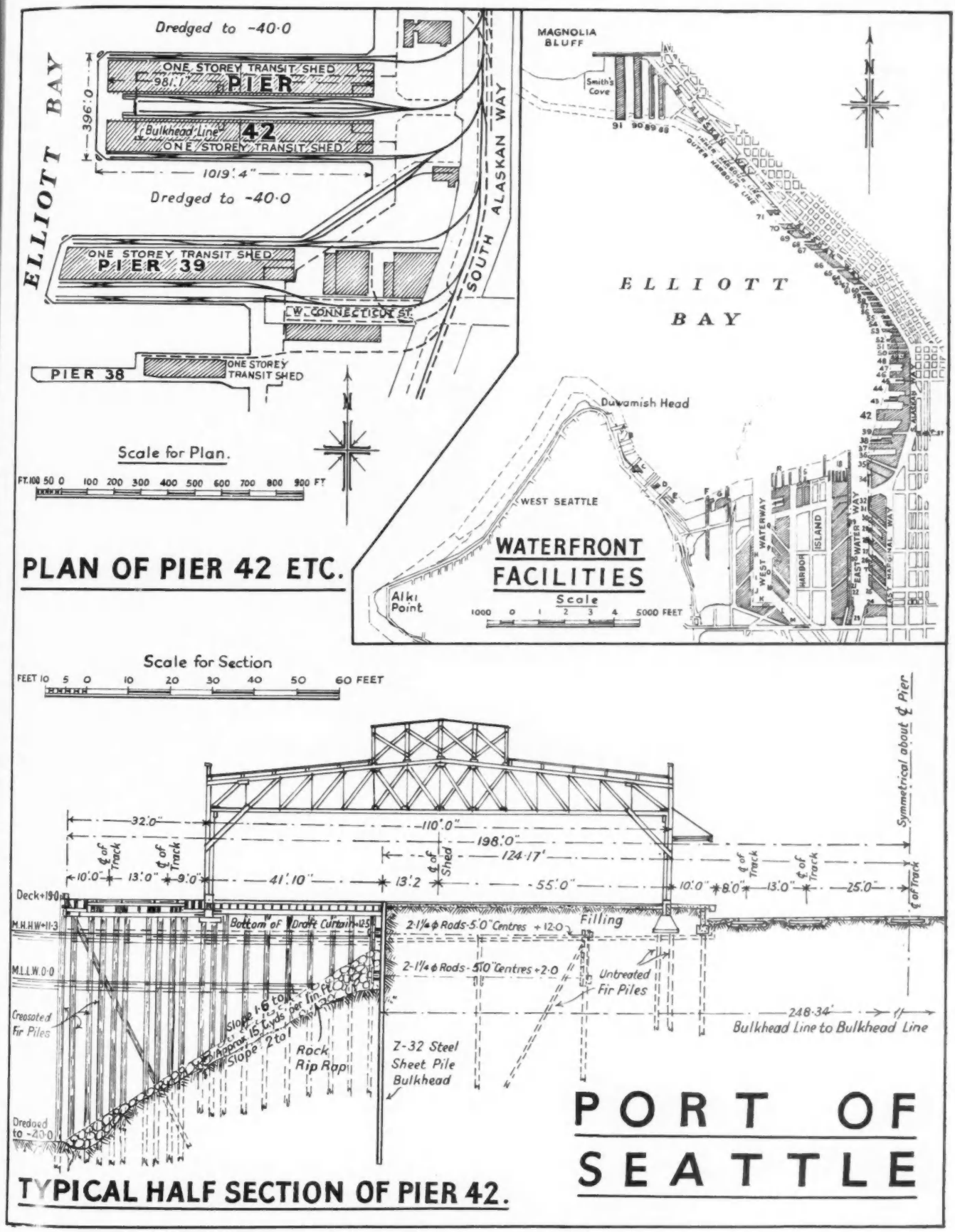
A large amount of construction work was necessary to carry out the modernisation programme. The first job included construction of 150 lineal feet of concrete bulkhead, 1,650 lineal feet of sheet pile bulkhead, 270 lineal feet of concrete drain line, 38,000 cubic yards of dredging, 154,000 cubic yards of filling, and 8,500 cubic yards of grading.

Two new 60-ft. by 100-ft. net sheds were constructed and two 625-ft. sawtooth piers were built in 1951. The south end of Pier H was extended to provide a 36-ft. by 100-ft. loading dock. The sawtooth mooring piers were originated in 1939 by the Port of Seattle engineering staff under the direction of the general manager and of the chief engineer. Their installation attracted such national attention that this type of pier has been copied by major fishing terminals in many sections of the country.

The Port of Seatle is unique in having both a salt-water harbour and a fresh-water harbour. A canal connects Lakes Union and Washington with the sound. The fishing boats are thus able to moor in Lake Union during the winter months when they are laid up and thus rid themselves of barnacles.

East Waterway Terminal

With the awarding of a contract for $307,000 in September of 1952, work was started on the first unit of a project designed to complete the extension and modernisation of the Port of Seattle's East Waterway Terminal. This is the initial phase of the Port's comprehensive plan to rebuild East Waterway. When completed, it will increase


Dredged to -40·0
ONE STOREY TRANSIT SHED
981'·1"
PIER 42
Bulkhead Line
ONE STOREY TRANSIT SHED
396'·0
1019'·4"
Dredged to -40·0
ONE STOREY TRANSIT SHED
PIER 39
W. CONNECTICUT ST.
PIER 38
ONE STOREY TRANSIT SHED
ELLIOTT BAY
SOUTH ALASKAN WAY
Scale for Plan.
FT. 100 50 0 100 200 300 400 500 600 700 800 900 FT
PLAN OF PIER 42 ETC.
MAGNOLIA BLUFF
Smith's Cove
ELLIOTT BAY
Duwamish Head
WEST SEATTLE
Alki Point
WATERFRONT FACILITIES
Scale
1000 0 1 2 3 4 5000 FEET
Scale for Section
FEET 10 5 0 10 20 30 40 50 60 FEET
32'·0"
110'·0"
198'·0"
124'·17'
41'·10"
13'·2
55'·0"
10'·0"
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8'·0"
13'·0"
25'·0"
℄ of Track
℄ of Shed
Symmetrical about ℄ Pier
Deck +19·0
M.H.H.W +11·3
M.L.L.W. 0·0
Bottom of Draft Curtain +12·5
2-1¼ ϕ Rods-5'·0" Centres +12·0
Filling
2-1¼ ϕ Rods-5'·0" Centres +2·0
Untreated Fir Piles
Creosoted Fir Piles
Slope 1½ to 1
Approx. 15 Cyds. per lin. ft.
Slope 2 to 1
Rock Rip Rap
Z-32 Steel Sheet Pile Bulkhead
248·34'
Bulkhead Line to Bulkhead Line
Dredged to -40·0
TYPICAL HALF SECTION OF PIER 42.
PORT OF SEATTLE

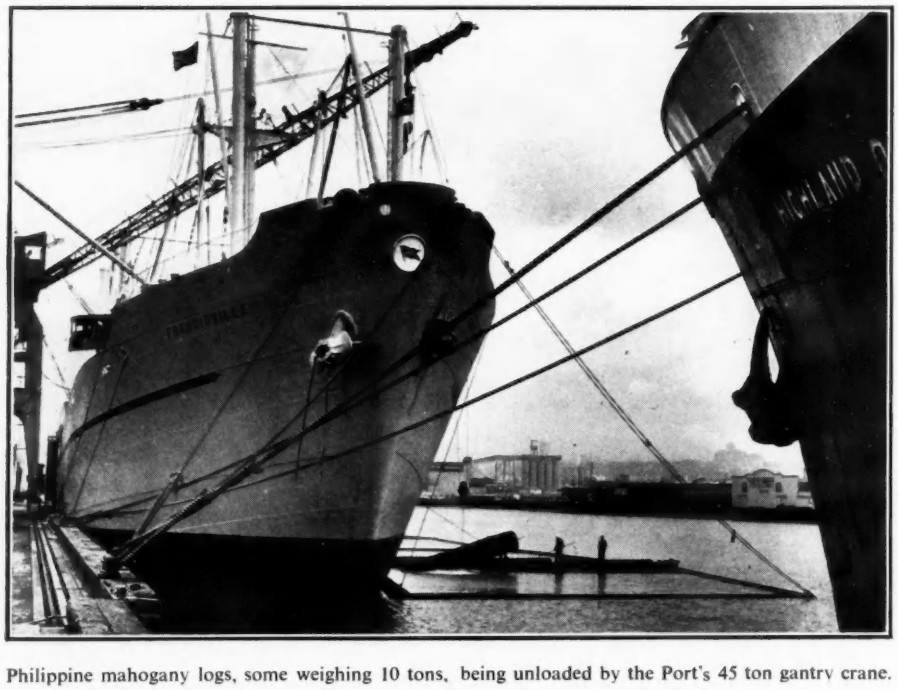
Port of Seattle—continued

considerably cargo handling and berthage space at the terminal, and will make it one of the most modern public terminals in the Pacific Northwest.

The project calls for approximately 56,000 square feet of wharf-area construction. Wharf construction will allow a 75-ft.-wide apron for handling all types of cargo to and from vessels.

Construction of a 190-ft.-wide transit shed is now under way. This shed, when finished, will extend the full length of the wharf, and will provide a means for segregating cargo as well as making available 18,000 square feet of covered storage area. The new wharf will allow three full 570-ft. berths.

Crane rails are being provided on the new construction for operation of a 50-ton capacity gantry.



Philippine mahogany logs, some weighing 10 tons, being unloaded by the Port's 45 ton gantry crane.

Ultimate development of the terminal includes demolition of existing storage tanks and structures built during World War I, and rearrangement of trackage to serve the open storage area more efficiently. The tank capacity for non-combustible liquids at East Waterway amounts to 5,860,000 gallons.

Spokane Street Terminal

In the autumn of 1952, the Port of Seattle completed the construction of the three-storey cold storage plant at its Spokane Street Terminal to supplement the seven-storey warehouse. This plant was built to meet the ever-growing demands of Seattle's frozen-fish industry, which is fast becoming a major enterprise due to improved methods of freezing and handling of frozen fish for shipment to the East.

The $470,000 addition to the Spokane Street Terminal is a 100-ft. by 147-ft. reinforced concrete structure, and has a capacity of 3,600 tons. The first floor consists of four refrigerated rooms and a refrigerated corridor to the fish-handling house, as well as a through traffic corridor. The second and third floors each has four refrigerated rooms. Operations are speeded by two four-ton capacity elevators. All rooms in the plant are designed to be operated at -10 degrees Fahrenheit. In 1951 the major improvements at Spokane Street were the removal of 30,000 square feet of apron and installation of double tracks and crossovers at a cost of $190,000.

Small Boat Basin

Now nearing completion is the first small-boat basin ever to be constructed on the downtown waterfront on the former site of historic Pier 58. This Pier is the old Schwabacher Wharf which is noted for two specific events which made history in the early days of Seattle. One was the arrival of the steamship "Portland" from the Yukon on July 17, 1897, carrying the famed "ton of gold" that touched off Alaska's great gold rush. The other was the berthing of the "s.s. Miike Maru" on August 31, 1896, at the Schwabacher Wharf, inaugurating the first regularly scheduled steamship service between Seattle and the Orient.

Decision to convert the famous landmark was prompted by the impracticability of modernising the pier.

The construction of the small-boat basin will make it possible for boats to discharge or take on passengers at a location easily accessible to the business district, and will make it unnecessary for pleasure craft to make the long trip through the Government Locks for moorage. The Port Commission plans to lease the large wharf area in front of the moorage to private operators who would construct suitable buildings and facilities. It is interesting to note that Seattle is second only to Long Island in its number of pleasure boats.

The project will cost approximately $80,000, and will have three slips that will provide moorage for 25 small craft. A 17-ft.-wide promenade will run the entire southern side, and a moorage will be built alongside the promenade for large sightseeing boats.

Foreign Trade Zone

One of the Port's major accomplishments in recent years was the establishment of Foreign Trade Zone No. 5 in September, 1949. The Zone is an enclosed area, to all intents a little piece of foreign country right in the middle of the city. It offers new methods which save time and money for foreign traders. As with all such zones, Foreign Trade Zone No. 5 has numerous operational advantages such as freedom from customs duties and regulations as long as the merchandise remains in the Zone, elimination of duty losses on shrinkage, waste, breakage and culls, and re-exportation of goods free of duty

Having the Zone in Seattle attracts general business and tonnage to this port which would otherwise go elsewhere. The Zone was opened with public approval and with the public knowledge that it would lose money for a minimum of eight years. The losses developed as expected, and they are heightened by the fact that under federal law the Port of Seattle must pay the salaries of U.S. Customs personnel who are on duty, needed or not, 24 hours a day.

From September 1, 1949, to June 30, 1952, a period of two years and nine months, the Zone's net loss was $111,640.00. Of the total expenditures of $269,573, customs salaries amounted to $102,239, or approximately 40 per cent.

The operational value of the Zone to shippers and traders is shown by statistics. During the period under review the Zone has received cargo from 32 foreign countries and has handled 29,176 tons of merchandise with a value of $16,163,514.00.

Airport

A facility of the Port of Seattle which has carried the name of the city to the remotest foreign lands in the $13-million Seattle-Tacoma International Airport. Designed by the Port of Seattle engineering department, this airport is one of the finest in the world and contains the most modern features and conveniences presently known in airport construction.

Traffic through the airport has increased month after month, due in part that Seattle is substantially closer via Great Circle Routes to the Orient than any other major American city and is the gateway to Alaska. It is estimated that traffic in and out during 1954 will exceed 1,000,000 passengers.

During 1953 in and out mail totalled 10,020,998 pounds, a gain of 1.3 per cent. over 1952. An increase of 40.7 per cent. in air freight was registered in 1953 over the previous year, or 20,549,634 pounds as compared to 14,604,242 pounds.

When the airport was opened in 1949 it had four airline tenants. It is now served by seven major airlines: Alaska Airlines, Northwest Airlines, Pacific Northern Air-

Port of Seattle—continued

lines, Pan American World Airways, Trans-Canada Air Lines, United Air Lines, and Western Air Lines. Round the world flights, east or west, are a matter of daily routine in and out of Seattle.

Federal Government installations at the airport include the Weather Station, Post Office, CAA Regional Control, Immigration Service, Customs Service, Public Health Service, and Department of Agriculture.

Among the many facilities provided for the Convenience of travellers are the dining room, coffee shop, cocktail lounge, service station, guarded parking, underground garage, car rentals, gift shop, candy shop, nursery and valet service.

One of the major improvements undertaken at the airport in 1952 was the "revitalisation" of 6,100-ft. of the 7,500-ft. north-south runway, the major one at the airport. Work on the runway consisted of resurfacing with 3-in. of asphaltic concrete, sub-sealing of areas where pavement had settled, and cleaning and re-sealing of paving joints. The work was necessitated by the increased weight of passenger planes operating out of the airport.

Now under construction are the Pan American World Airways hangar, costing $650,000, and the Western Air Lines hangar, costing approximately $300,000.

Plans for future development of the airport are being prepared. With the steadily growing air-freight traffic through the airport, the Port of Seattle has under consideration the construction of a modern air-freight terminal. Aviation moves quickly, and the modern airport must move quickly, too, to keep pace with the demands of the industry.

Over 1,700 people are employed by the airlines, government agencies and others at the airport with an annual payroll exceeding $6 million.

Future Development

In line with its policy of constant development of maritime commerce and expansion of industry, the Port of Seattle Commission has under consideration four major projects: the development of the central waterfront through construction of a marginal wharf facility extending from Bell Street to Madison Street, development of a terminal for handling bulk material, modernisation of its grain elevator, and development of Duwamish Waterway from Spokane Street to Renton Junction—in co-operation with the City of Seattle and King County—for shipping and for construction of additional industrial sites.

Continued improvement of and addition to present facilities to meet the requirements of expanding trade and traffic are also planned. At Spokane Street Terminal the capacity for cold storage of box and bulk frozen fish will be increased. At Hanford Street Terminal, grain storage and handling facilities will be improved, while at Stacy-Lander Terminal cargo-handling facilities will be added. Future plans for Fishermen's Terminal at Salmon Bay include construction of additional buildings, stores, piers and boat-repair facilities to make it the best and largest fishing fleet haven in the world.

The Port of Chalna

New Anchorage in Pussur River

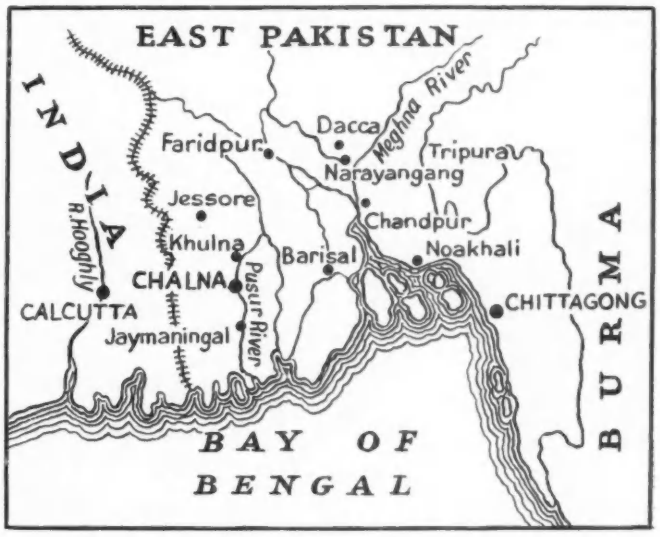
By Capt. T. J. M. MACKENZIE, Chief Marine Superintendent, Thos. & Jno. Brocklebank, Ltd.

When last I wrote an article on my visits to Chalna late in 1950 and early in 1951 I was bold enough to prophesy that the port had great possibilities and that, given time, those in charge of administration would overcome the difficulties that are associated with the construction of a new port. Much has been done in four years and much remains to be done—the period of trial and error is not yet over. The port, however, has progressed and the attached statistics prove conclusively that trade, both export and import, has expanded at a rate that must be a source of gratification and pride to the Pakistan authorities.

During the four years the port, or anchorage as it is often called, has occupied three different sites. The first position was at Jaymaningal, which is half-way between the river entrance and the railway terminal town of Khulna. Although the anchorage at Jaymaningal was ideal for deep-sea vessels, it was found that the river during the S.W. Monsoon was too turbulent for the river craft to work satisfactorily, and a new anchorage had to be found. Two years ago the port was moved up river to Chalna, a small village about 20 miles below Khulna. This anchorage, situated near the confluence of three rivers, although closer to the railway terminus, proved unsatisfactory and was a constant source of anxiety during the S.W. Monsoon. The anchorage has now been moved again to a site about ten miles below Chalna at a position close to the entrance of the Mongla River. It is expected that this site, which was first occupied on 20th June, 1954, will prove satisfactory.

Experience up to date by Masters, pilots and officials using the new anchorage is that it is safer and vessels lie much quieter at all stages of the tide. Six moorings have been laid and there is ample room for large vessels to swing freely at their moorings. There is also room for several vessels to load or discharge cargoes on their own anchors.

A glance at the map will show the position of the new anchorage and its relative position to the railway terminus and the jute-growing area. Land has been acquired and developed on the eastern bank of the Pussur and a labour colony has been built. During the coming winter it is the intention of the authorities to proceed with the construction of a Hospital, Harbour Master's Office, pilots' quarters and other buildings necessary for harbour administration.



During the period since opening the port it will have been observed that the authorities are ever on the alert to find the stretch of the river that will prove to be the best situation for all concerned and a safe haven for deep-sea vessels. The river, which in reality is not a river but a gigantic creek, is a natural waterway, being free from bore tides and severe freshets. In addition to a Light Vessel at the entrance there are lighted buoys on the entrance bar. This enables vessels to traverse the bar at night time and so take advantage of the higher tides, which are higher at night than in daytime. Beacons have also been fitted at the principal points and crossings lighted. There is a good tug, the "Moeen," available, also two water barges. A Radio Beacon is being erected at Hiran Point which, when in position will be a valuable aid to navigators making the port.

At the head of the river, as already mentioned, stands Khulna, where the office of the Port Director is situated. It is proposed to erect a jetty here for the use of harbour craft and of the various river craft which will convey import cargo from the vessels in the river to the jetty for Customs inspection. It is understood that when this jetty is completed, together with cargo warehouses, the port will open for general imports.

In the area surrounding Chalna, particularly Narayangang, Dacca and Khulna district, several very large and up to date Jute Mills have been constructed and some of them are in full produc-

Port of Chalna—continued

tion. These mills process the raw jute into Hessian cloth—good progress indeed when it is realised that four years ago East Pakistan did not possess one Jute Mill.

In conclusion I would like to remind readers that when this port was opened four years ago it was prophesied that it would be unsafe in the S.W. Monsoon. We have now the experience of four adverse weather periods and to the best of my knowledge there has not been a Marine casualty of any magnitude.

Finally I am indebted to Mr. E. S. B. Bhombal, the energetic Port Director, who has supplied me with most of my information, and whose authority I have to publish the statistics appended hereto.

Traffic (Vessels and Tonnage).

	December, 1950, to March, 1951			April, 1951, to March, 1952	
	Gross	Net		Gross	
No.	Tonnage	Tonnage	No.	Tonnage	Tonnage
7	41,418	25,598	89	539,439	324,996
	April, 1952, to March, 1953			April, 1953, to March, 1954	
	Gross			Gross	Net
No.	Tonnage	Tonnage	No.	Tonnage	Tonnage
147	847,481	503,304	189	1,152,411	684,192

Details of Imports and Exports (Principal Commodities).

IMPORTS

Commodity	December, 1950 to March, 1951	April, 1951 to March, 1952	April, 1952 to March, 1953	April, 1953 to March, 1954
	Tons	Tons	Tons	Tons
Foodgrains	1,429	36,036	59,184	34,266
Salt	—	62,575	43,268	40,245
Kerosene Oil	—	3,286	16,041	8,743
Coal	—	4,500	—	—
Cement	—	7,000	—	7,379
Machinery	—	15,063	12,312	12,754
Cotton and General Cargo	—	1,469	5,723	14,128
Steel	—	—	10,639	—
Total	1,429	129,929	147,167	117,515

EXPORTS

	Bales	Bales	Bales	Bales
Jute	182,691	1,253,489	1,390,151	1,709,578

New Floating Dock at Götaverken

Largest in Scandinavia

(Specially Contributed)

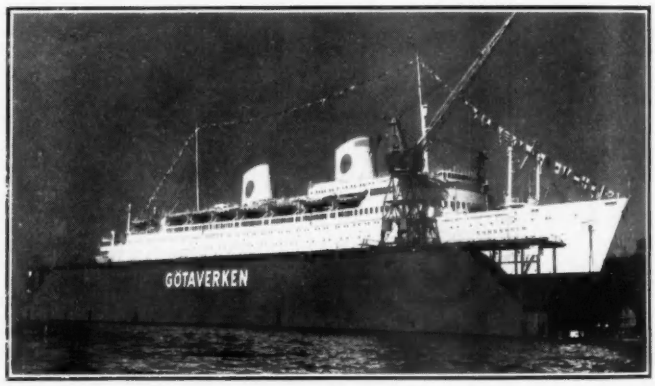
The docking of the M.S. "Kungsholm," flagship of the Swedish American Line, in the large new floating dock of Götaverken was made the occasion of an inaugural ceremony on September 3rd, 1954, presided over by the Minister of Commerce, Mr. John Ericsson. The new dock is the largest in Scandinavia and the fifth largest in Europe; it will be able to accommodate vessels of up to 45,000 tons d.w., and its lifting capacity is 28,000 tons. It has an inside breadth of 30.5 m. (100-ft.); the length is 217.7 m. (713-ft.); the outside moulded breadth 40.5 m. (133-ft.); the largest water depth over the keel-blocks, 9 m. (30-ft.); and the largest draught 16.2 m. (53-ft.). Below the dock a depth of 18.5 m. (60-ft.) has been dredged, which means that the hollow beneath the dock is twice as deep as the port fairway.

Since the 1930's there have been plans at Götaverken to procure a larger floating dock than those of 8,000 and 18,000 tons lifting capacity already owned by the yard. During the war the plans had to be postponed, but soon after the cessation of hostilities it became evident that the sizes of ships, and especially of tankers, were increasing so that the building of a new dock became a question of urgency, particularly after the signing of contracts for tankers of 34,000 tons d.w. Accordingly the design was revised under the supervision of Chief Naval Architect Mr. Nils Svensson, and tenders for building the dock were invited early in 1951. The quotation of the Belgium shipyard of Boel & Sons of Tamise was accepted, and the question of steel supplies presented no difficulties as the Belgian shipyard delivered all the rolled material, totalling about 8,000 tons of steel.

In May, 1954, the "hull" of the dock moved down the Schelde river, and arrived one week later at Gothenburg, where the dock was completed and equipped. Two cranes of a capacity of 12 tons each have been erected, one on each wall. A comprehensive electric control and pumping system has been installed; the wiring amounts to 25 km. (15½ miles). The piping arrangement is also extensive and amounts to 11 km. (7 miles). The painting of the pontoons and walls, internally and externally, involved covering a surface of 125,000 sq. m.

The hull consists of 10 pontoons and two walls. The pontoons are bolted together and to the walls, an arrangement which makes it possible to disconnect them from each other if it is desired to lift one or more of them in the dock for survey. Thus the dock is "self-docking." The end pontoons of the dock also have been designed with dimensions and lifting capacity large enough to be used for lifting the existing 18,000 tons of floating dock for repairs and painting.

Both the pontoons and the walls are all-welded. The walls, which have to resist the longitudinal stresses are longitudinally framed. Another special feature is a crane deck on top of the walls. This deck will of course increase the longitudinal strength of the dock, but its main purpose is to provide a deck with free space for the cranes. Employees and the crew of the ship are not allowed on the crane deck, which is important both from a working and a labour safety point of view.



The M.S. "Kungsholm" in Götaverken Dock.

The main control room is situated on the manoeuvring deck from where the dock engineer can operate the 20 large pumps each with a capacity of 1,100 cu. metres (39,000 cu. ft.) water per hour, 18,400 litres (600 cu. ft.) per minute. From the control room the distribution valves, etc., can be regulated, and a large indicator panel shows the water level in all the separate tanks. There are also trim and heel indicators recording every change in the position of the dock, and instruments for the hydraulic and optical measurement of a possible deflection of the dock when lifting a ship. The dock engineer is thus in a position to correct a deflection by suitable re-distribution of the water in the tanks.

On the manoeuvring deck there are also large a.c./d.c. converters for the supply of electricity to the docked ships. The equipment in the walls includes a modern welding plant, workshops, and sanitary arrangements for the crews of the ships and the docking personnel.

Instead of a safety deck such as fitted to most floating docks the new Götaverken dock is equipped with a system of electrical "level guards," which operate when the dock has been lowered down to 30-ft. above the keel blocks. The level guards automatically shut all the distribution valves and at the same time sound and visual warning is given to the dock engineer if, contrary to expectation, the maximum permissible draught is exceeded. This is a new arrangement for floating docks.

The new dock is valuable addition to the ship repairing facilities at Götaverken, and will enable the yard to accommodate the larger tankers which are now on order.

Diesel Hopper barge at sea.
DREDGING SPECIALISTS
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THE COMPLETION OF A HARBOUR .....

Consulting Engineers : Messrs. Rendel, Palmer & Tritton

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DREDGING & RECLAMATION

AT THE PORT OF ADEN

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Consulting Engineers : Messrs. Rendel, Palmer & Tritton

Further large scale dredging and reclamation operations are now being commenced by the Joint Companies on behalf of the Aden Port Trust as part of the Port Improvement scheme.

Consulting Engineers : Sir Bruce White, Wolfe Barry & Partners

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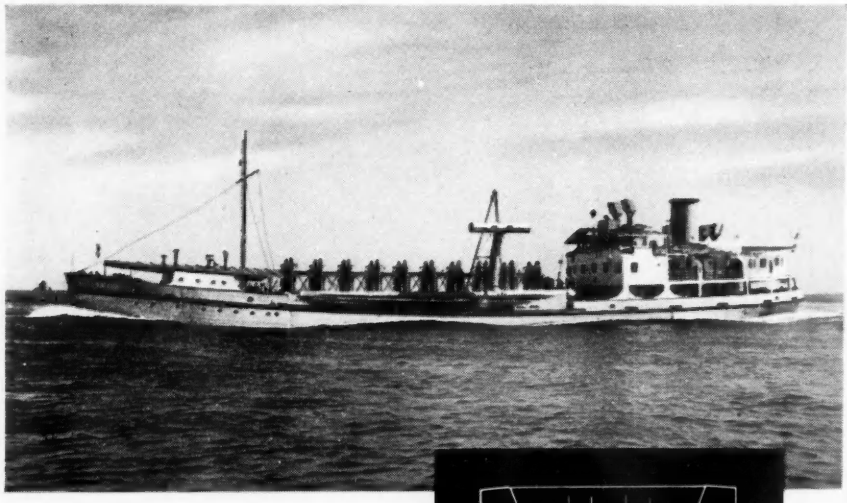
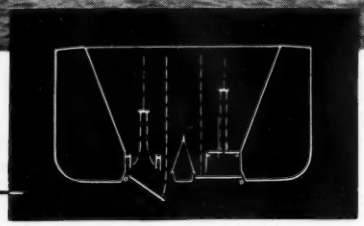
NUMBER ONE

I.H.C. HOLLAND NEWS ITEMS

A BI-MONTHLY BULLETIN ON DEVELOPMENTS IN DREDGING

RELIABLE WELL-TRIED SELF-DISCHARGING SYSTEM





Lower purchase costs and less maintenance

After the bucket dredger, the next most frequently used type is probably the suction hopper dredger. These craft are often equipped with self-discharging apparatus which enables them to deliver their spoil directly on to the shore.

Self-discharging installations give such vessels increased scope — but they cost money. Normally, diluting water equipment is necessary — and this means an extra engine, together with a pump and piping. Maintenance costs tend to increase. And, of course, space is needed for the installation.

A *simplified* type of self-discharging suction hopper dredger has been built by I.H.C. Holland, ever since 1895.

The hopper compartment is fitted with two double rows of bottom doors. These form a duct which runs the full length of the compartment. One end of the duct is open to the water outside, whilst the other end is connected to the suction side of the dredge pump. Water is drawn through the duct, the upper doors are opened, and the spoil falls into the flow. Hence it is drawn into the pump and delivered ashore.

This simplified system has many advantages — which result in a considerable saving both in purchase price and maintenance costs.

Because there is no diluting water installation, less engine room is needed and, consequently, the vessel is smaller than other types. And, naturally, there are fewer repairs.

Simplicity makes for easy handling, and allows non-stop working. Almost any kind of spoil may be worked in this way.

The capabilities of these dredgers have been tested and proved in action over fifty years. Today, they can be seen at work almost anywhere. But if there is any detail you would like to know about them, please do not hesitate to write to I.H.C. Holland.

DID YOU KNOW?

The oldest company in the I.H.C. Holland group has been building ships for over a century and a half; the youngest is forty years old. Together, the 6 companies in the group have delivered more than 3,000 orders.

*

Under a single control, I.H.C. Holland offers: 27 shipbuilding berths, 6,000 skilled workers, and advanced construction methods backed by the experience of generations. Their bulletin No. 1 tells you why and how.

*

Most mechanical equipment for vessels built by I.H.C. Holland is made in the associated engineering works. The equipment — which includes diesel engines, complete steam installations and pumps — is specially produced to the exact requirements of the yards.

*

A film showing the advantages of modern shipbuilding methods — both for purchasers and builders — has been made by I.H.C. Holland. The film is 16 mm, with sound. Copies are available for showing at conventions of engineering associations, congresses, etc. Interested parties are invited to write.

You'll find other interesting I.H.C. Holland News Items in the next issues.

The six partners are:

Conrad-Stork	**Haarlem**
Werf Gusto	**Schiedam**
De Klop	**Sliedrecht**
J. & K. Smit	**Kinderdijk**
L. Smit & Zoon	**Kinderdijk**
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3rd September, 1954

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Dear Sirs,

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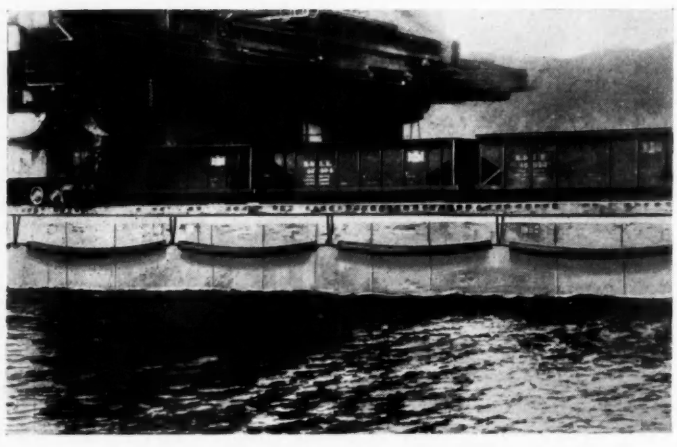
EXTREMELY high shock resistance is but one outstanding feature of Goodyear Rubber Fenders. It has an amazing capacity to absorb impacts of tremendous force without shattering, and the resilience to regain its original shape with efficiency unimpaired.

Its resistance to weather and abrasion is remarkable, too. An installation serving ore-laden freighters on Lake Erie has been in service over 20 years!

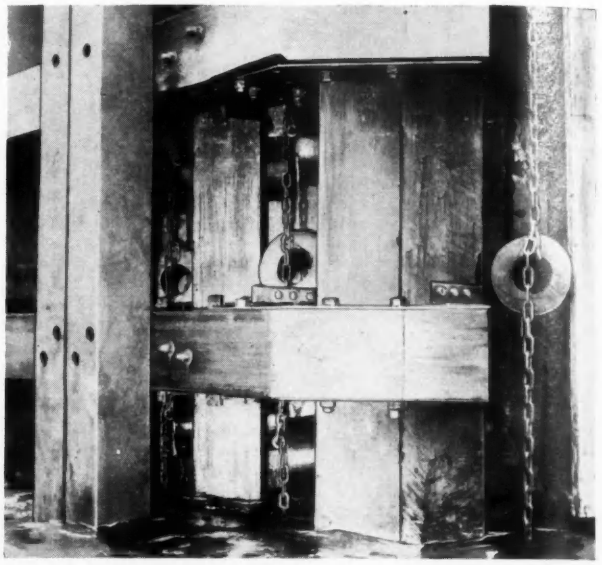
The versatility of Goodyear Rubber Fendering is no less important. It is a material that lends itself to efficient combination with other fendering materials (as shown by the installation at Dover illustrated here), yet may be used alone to provide effective protection.

LONG LASTING, LOWERS COST

In ports all over the world, Goodyear Rubber Fenders have shown conclusively that no other fendering is so thorough, saves more money all round or lasts for such a long time. Low maintenance and replacement expense makes the overall cost of Goodyear Rubber Fendering far lower than that of older, less protective methods or mechanical installations. This superior form of protection quickly pays for itself many times over in its long, gruelling life.



These Goodyear Dock Fenders were installed at the Pittsburgh & Conneaut Docks, Lake Erie on May 4th, 1933. They have seen constant heavy duty while docking Great Lakes ore and coal "freighters" — recovering from blows that long ago would have destroyed more common types of fender. After 21 years of service they are still in excellent condition.



The versatility of long-lasting Goodyear Rubber Fenders
This illustration shows them used in conjunction with other fendering material on dolphins at the Dover car ferry terminal.

Advantages of Goodyear Rubber Fenders

★ High Energy Absorption — Considerable kinetic energy can be absorbed without damage.

★ Eliminates mechanical shock absorbing devices.

★ Practically immune to the effects of abrasion, ageing, rotting, corrosion, etc. Gives completely satisfactory service under a great variety of climatic, tidal and operating conditions.

★ Easy to install. Simple to secure by cables, chains or bolts. May be installed horizontally, vertically or diagonally. The particular needs of every installation can be dealt with simply and effectively.

★ Low maintenance cost. Special compounded rubber ensures resistance to wear and all weathers. At a recent detailed examination of fendering in service for 15 years it was found to be as good as new.

★ Tough and resilient. Can compress up 1/3 of original thickness without damage.

★ Extremely adaptable. Depending on the type of structure, the impact to be absorbed and the operating conditions at the site, Goodyear Rubber Fenders can be used alone or in conjunction with other types of fenders.

★ Choice of section. Goodyear Rubber Fenders for dockside or ship are made in a range of sizes of circular and rectangular section. A specially neat D section is made for small craft.

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Operation and Maintenance of Steam Shunting Locomotives

Problems Confronting Dock and Industrial Engineers

By A. O. HELPS, A.M.I.Mech.E., M.I.Struc.E., and
R. H. NICHOLSON, A.M.I.Mech.E., A.M.I.Loco.E.
(Engineer-in-Chief's Department, Port of Bristol Authority).

THE problems of locomotive operation and maintenance confronting the Docks or Industrial Works' engineer differ greatly from those of his counterparts working for a main line concern. There, responsibility for providing maximum availability, together with sound mechanical condition, is shared between the various Main Workshops, whose job it is to carry out general overhauls at stated intervals, and the Motive Power Depôts which run and maintain the locomotives on a day-to-day basis. For obvious reasons, every facility is provided for this purpose and all locomotives are maintained to a very rigid schedule, both so far as their main overhauls at works are concerned, and between these. Both administrative and actual maintenance duties are carried out by staff trained basically for this work, with little else to occupy them except locomotives in one way or another.

This is not so in the case of the Industrial engineer (who is responsible for plant of all types) and who has, possibly, little or no specialised railway training whatsoever. On Docks Estates, in particular, the locomotive is an exceedingly vital piece of operative machinery, often subjected to much abuse and overload, but still expected to proceed without failure. Maintenance facilities do not often extend beyond those offered by a general all-purpose workshop, whose staff are expected to carry out all main overhauls in addition to their other many and varied duties.

The writers of the following article are responsible for the maintenance and operation of 19 steam locomotives under this category, all of which are the usual type of 0-6-0 saddle-tank industrial shunter, with two outside cylinders and Stephenson valve gear. These locomotives have tractive efforts ranging from 11,000 lbs. to 15,000 lbs. and are employed solely on transfer-shunting duties, in different sections of the Authority's 90 miles of track. The system for their maintenance is one developed by the writers over a number of years, and it is hoped that some details may prove of interest to other engineers placed under similar circumstances.

Running Shed Organisation.

The running shed is under the immediate control of a foreman, not technically trained, but promoted from the footplate staff—therefore well qualified to deal with staffing and rostering arrangements for the various turns of duty. All main overhauls are carried out in the workshops, but there is one fitter permanently allocated to the running shed who is responsible for minor running repairs and adjustments which are often necessary during preparation time and the mid-day dinner break. The major part of the latter's working day is spent on the examination and repair of any of the locomotives stopped for washing-out, an operation which is naturally carried out in the running shed.

Boiler Washing Out.

All boiler washouts are done during the day shift, by the gang of engine cleaners on duty at this time. As cold water is used for this operation, a system has been adopted whereby the boiler is cooled down at a uniform rate, preparatory to the actual washing out. By taking this initial precaution against over-rapid contraction, stay and tube leakage is reduced to a minimum. When the locomotive scheduled for washing out has come to shed the previous evening, and disposal duties have been completed, the steam remaining in the boiler is utilised to fill the boiler, as far as possible at least to a minimum of half a glass of water on the gauge column. The damper and firehole doors should be closed. The injector steam valve is then partially opened and all remaining steam in the boiler allowed to exhaust through the overflow pipe. When the night shift cleaners' squad have signed on for duty, cooling-down of the boiler takes place. One of the washout plugs immediately above the firebox crown is first removed and a tubular nozzle, 6-ft. long is inserted inside the boiler. A screwed adaptor on the end of the nozzle ensures that it can be positioned tightly in the plug hole. One end of the wash-out hose is then coupled to the adaptor, and the other end to a hydrant valve on the shed floor. The topmost washout plug in the boiler backplate is then removed and another adaptor screwed in to which is connected a second length of hose, the free end terminating in the locomotive

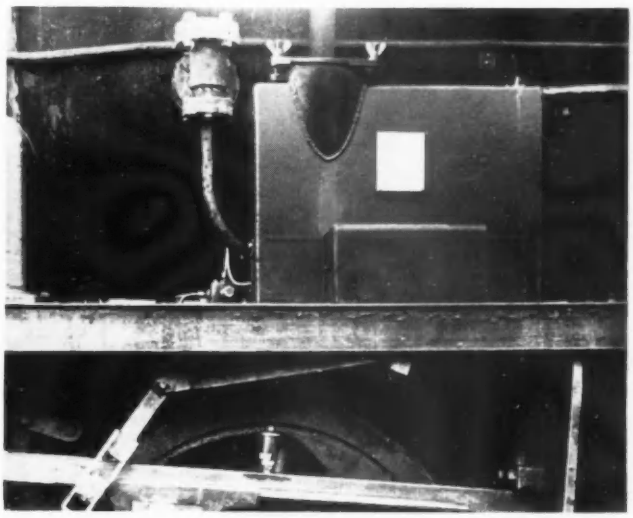


Fig. 1. I.C.I. "Alfloc" chemical feeder fitted to locomotive footplate, showing chemical tank and drive to pump from the crosshead.

pit. The hydrant valve is then opened and cold water enters the boiler through the nozzle. When the level reaches the adaptor fitting in the top plug hole, the water overflows into the pit and goes to waste. By running cold water into the boiler and allowing it to mix with the hot water already there, cooling down takes place very gradually. The boiler is cooled down in this manner for not less than five hours and on completion emptied of all water.

In order to obtain uniform contraction of the boiler, the hydrant valve is regulated to give the following delivery over the cooling down period:—

No. 1 position—first two hours	...	2¼ gallons/min.
No. 2 position—second two hours		6 gallons/min.
No. 3 position—final hour	...	20 gallons/min.

All the gear used is manufactured in the Authority's own workshops.

For the purpose of boiler washing, all washout plugs and mud-hole doors are removed. Boiler washing is started at the firebox crown, which, with the vertical stays is thoroughly cleaned of scale (if any is present) by rodding through the plug holes. The boiler barrel is then cleaned by further rodding from the smokebox tubeplate end. The water space in front of the firebox tubeplate is dealt with in a similar manner. All scale and sludge thus removed is then swilled away through the mud-hole doors at the

Operation and Maintenance of Steam Shunting Locomotives—continued

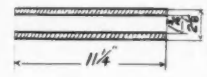
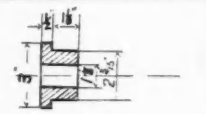
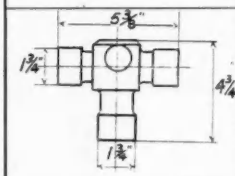
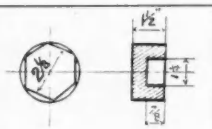
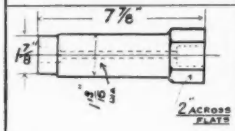
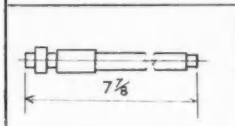
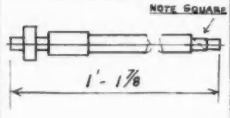
foundation ring. On completion of the operation all plugs and doors are greased or rejointed and replaced. The boiler is then refilled and made ready for lighting up and steam raising.

The duration of time taken for each specific operation is considered to be very important, therefore contraction and expansion are controlled as uniformly as possible. The minimum periods laid down are as under:—

(1) Blowing down steam ... 3 hours.
(2) Cooling down boiler ... 5 hours.
(3) Filling boiler and raising steam 5 hours.

Although impossible to effect at the writers' establishment, it is considered advisable for boilers to be examined by a competent

LOCOMOTIVE SPARE PARTS CONTD ALL CAST SIZES. (4)

SKETCH OF SPARE	DESCRIPTION & MATERIAL	PATTERN No
	SLIDE VALVE SPINDLE GLAND BUSHES GUNMETAL. GRADE "B" 88% 2% 10%	10,541
	SLIDE VALVE SPINDLE NECK BUSHES GUNMETAL. GRADE "B" 88% 2% 10%	10,542
	WHISTLE VALVE BOX GUNMETAL. GRADE "C" 90% 2½% 7½%	9,089
	WHISTLE VALVE UNION NUTS GUNMETAL GRADE "C" 90% 2½% 7½%	8,542 SAME PATTERN AS INJECTOR VALVE BOX NUT
	STEAM BRAKE EXTENSION ARM GUNMETAL GRADE "C" 90% 2½% 7½%	10,392
	SHORT STEAM BRAKE VALVE SPINDLE GUNMETAL. GRADE "C" 90% 2½% 7½%	
	LONG STEAM BRAKE VALVE SPINDLE GUNMETAL GRADE "C" 90% 2½% 7½%	FIG. 2

boilersmith before the locomotives are returned to traffic. All firebox stays should be hammer tested, and if any are found defective, renewed immediately. Opportunity should also be taken to expand any tubes reported leaking.

Water Softening Treatment.

The periodic washing-out of the boiler is directly related to the characteristics of the water it uses.

A typical analysis of the water which the writers' locomotives use gives a total hardness (temporary and permanent) of 24 parts per 100,000—or nearly 17 degrees. Approximately 75 per cent. of this figure is " temporary " or alkaline hardness, as most of the

STEAM LOCOMOTIVE WASHOUT & TRAFFIC DEMANDS - Oct. 1954

DATE	W.O$	LOCOMOTIVES WASHED OUT	T	R	S	W
FRIDAY 1ST	1	BRISTOL	14		2	2
SATURDAY 2ND	1	CLIFTON	15		1	2
SUNDAY 3RD	0	(NO WASHOUTS)	6		11	2
MONDAY 4TH	0	(NO WASHOUTS)	14	1	2	2
TUESDAY 5TH	1	HALLEN	14		2	2

LEGEND:- W.O$ = No of Locos Washed Out; T = No of Locos Working in Traffic; R = No. of Locos under Repair at Running Shed; S = No of Locos surplus to Traffic Requirements; W = No of Locos at Workshops for Overhaul

FIG. 3.

Total Washouts for Oct. 1954 = 20 Average Period 19 Days

dissolved salts in the water consist of the bicarbonates of calcium and magnesium. When water containing these bi-carbonates in solution is raised above boiling point, the CO_2 is liberated as a gas and the insoluble compounds of calcium and magnesium are precipitated as carbonates in the form of sludge or soft scale.

The main constituent present in the much smaller remainder forming the " permanent " hardness of the water is magnesium sulphate which is freely soluble at all temperatures. Concentration in the boiler increases with evaporation until solubility is exceeded, when it crystallises out, forming a sulphate scale which is hard and adhesive.

As the raw feed water contains no salts which would tend to liberate free acid, and as the balance between alkalinity and CO_2 is such that no pH correction is required, trouble from either acid or cold corrosion is unknown. Priming also has never been much of a problem, due to the relatively low concentration of dissolved solids in the feed water.

The main trouble arising in the boilers then, has always been due to scale formation on the heating surfaces. By calculation, assuming a total daily evaporation per locomotive of 15,000 lbs. of water, approximately 4 lbs. of scale per day is precipitated inside the barrel, and this has always necessitated frequent washing out at 8—10 days intervals. Although as much of the water space of the boiler as possible is always well rodded, scale formation on the more unattainable parts has led to a fairly high incidence of firebox plate patching and tube renewal due to local over-heating. Therefore, four years ago it was decided to apply some form of water-softening treatment to the locomotive boilers, with a view to gaining the following advantages:—

(1) An increase in locomotive availability due to anticipated longer intervals between boiler overhauls and longer periods between washing-out.
(2) A certain economy due to the resultant decrease in labour costs and new materials.

Due to the fact that locomotive watering points, dispersed over the whole dock area, are taken direct from the mains which feed

GENERAL LOCOMOTIVE REPAIRS TO BE CARRIED OUT

LOCO	BOILERWORK	TYRE WORK	REMARKS	IN	OUT

FIG. 4

Operation and Maintenance of Steam Shunting Locomotives—continued

other services, external treatment, although favoured, was out of the question.

After consideration it was decided to adopt a system where a suitable re-agent is injected directly into the boiler shell to treat the water already inside, so resulting in:—

(1) Precipitation of the scale forming salts in the boiler itself.
(2) Conditioning of the precipitate when formed.
(3) Efficient control of the concentration of both dissolved and suspended solids in the boiler water by blowdown.
(4) Prevention of any corrosion tendencies that might arise.

The re-agent used in the treatment is basically an alkaline liquor containing a coagulant. The chemistry of the treatment is well beyond the scope of this paper, but it will suffice to mention that the aim of the process is to precipitate the permanent hardness salts as a soft sludge which accumulates at the bottom of the boiler along with the precipitates from the temporary hardness salts (which break down at high temperatures quite naturally themselves)—a proportion of which is then removed by blow-down and any residual sludge by eventual wash-out.

It will be noted that the only reaction is between the re-agent and the permanent hardness salts, which are broken down to form a sludge and not allowed to crystallise out naturally as an adhesive scale, as they would do without treatment.

The method of applying the treatment is shown in Fig. 1. The apparatus consists of a 12 gallon welded steel chemical tank, inside of which is a precision-made stainless steel oscillating pump. This is activated by an arm and suitable linkage, directly coupled to the locomotive crosshead. The link motion is so designed that for a given crosshead travel, only the specified quantity of liquor is delivered per stroke when the locomotive is in motion. This is of fundamental importance and the relationship is based on the average daily total evaporation characteristics of the boiler. The pump delivers the liquid through a non-return valve and stop valve mounted on the boiler shell, whence it is fed into the steam space through a short standpipe.

Each boiler is blown down once daily to eject sludge accumulation which the treatment precipitates in the boiler shell. This is done manually, through an "Everlasting" blowdown valve mounted on the firebox side, which is controlled from a lever in the cab. As the correct amount of daily blowdown is integral with the treatment, it is carried out only by one man acting on instructions from the writers. To prevent unauthorised interference, the blow-down handle in the locomotive cab is always kept locked when not in use. Samples of water are tested by the writers once fortnightly, when an analysis is obtained of Hardness, Alkalinity, Chlorides and total dissolved solids, present in the boiler water. Such information is vital, as the whole success of the treatment depends on the correct inter-relationship and balance of these concentrations, which are maintained in order by varying the amount of liquor injected into the boiler Hardness of the water seldom increases beyond 1 degree. As the liquor is delivered in proportion to the individual evaporation characteristics of the locomotive, the only other variation likely to be required would be if the raw water was likely to change its composition.

This system has been employed now for four years and up to the present 9 locomotives are under treatment. As the chemical reactions immediately attack and remove old scale deposits which have accumulated on the heating surfaces over a period of time, in order to prevent immediate stay and tube leakages which might result, chemical feeders are fitted only:—

STEAM LOCOMOTIVE MAINTENANCE DATA SHEET

DATE CHART ADJUSTED	
5. 1943	
5. 1946	
7. 1948	
7. 1949	
6. 1952	
7. 1954	

NAME OF LOCOMOTIVE - HUDSON

DATE OF PURCHASE - 1915

RAPID APPRECIATION GRAPH

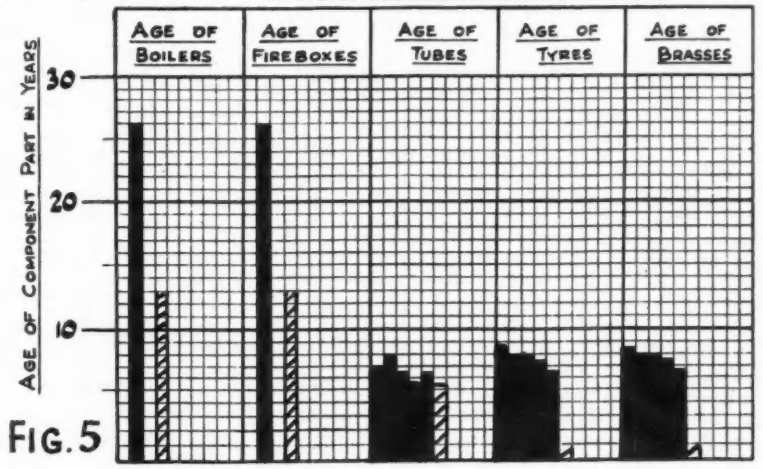


FIG. 5

GENERAL MAINTENANCE DATA

DATE OF PURCHASE OF LOCOMOTIVE - 1915
DATE OF COMPLETE BOILER RENEWAL - DEC. 1941
DATE OF FIREBOX RENEWAL - DEC. 1941

TUBES - 8'-6"			TYRES - C		BRASSES	
NEW	DRAWN UP	REFERRULED	NEW	TURNED	NEW	OVERHAULED
1915		6. 1918	1915	7. 1917 9. 1920	1915	
OCT. 1922		3. 1926 4. 1928	APR. 1923	8. 1925 4. 1928	APR. 1923	
OCT. 1930		10. 1930 1. 1933 2. 1935	JUL. 1931	2. 1935 6. 1937	JULY 1931	
MAR. 1937		3. 1937 8. 1940	AUG. 1939	2. 1942 8. 1945	AUG. 1939	
DEC. 1941		12. 1942 8. 1946 12. 1946	MAR 1948	7. 1949 6. 1952	MAR. 1948	
JULY 1949		7. 1949 6. 1952 10. 1954	FEB 1954		FEB. 1954	

(a) to new boilers
(b) to old boilers subsequent to a main overhaul, involving as complete a manual descaling as possible, and renewal of a full set of tubes.

It is the writers' intention to put all remaining locomotives on treatment as these conditions arise.

The employment of this system has resulted in a high increase of availability, as wash-out periods on treated boilers have been extended from 8—10 days to 2 months. This period could most probably be extended with safety, so far as the actual conditions of the boiler is concerned, but in view of the arduous duties performed by the locomotives from day to day, it is not considered advisable to protract this period, as mechanical adjustments would then get out of hand. Washing out operations are also greatly simplified due to the complete absence of scale on the heating surfaces, whereby all rodding is eliminated. Only a good pressure of water is required to remove all traces of sludge accumulations.

It has been determined from actual working conditions that the yearly cost of chemical feed per locomotive under treatment is in the region of £14. Against this, the average number of wash-outs per locomotive year has been reduced from about 35 to 6.

It should be borne in mind that the preceding remarks apply only to those locomotives which are equipped with "Alfloc" water softening apparatus. Washing-out procedure as detailed under the previous heading is still applied to those running on untreated water.

Operation and Maintenance of Steam Shunting Locomotives—continued

PARTICULARS OF LOCOMOTIVE TYRES & ROD BRASSES AS ON ..... AS GUIDE FOR MAINT^CE PROG^MME ..... COMPILED .....

Locomotive & Date of Purchase of Same	Is Engine viewed by G.W.R.	Date of New Tyres	Date Tyres Last Turned	Remarks on Tyres	Date New Side Rod Brasses Fitted	Remarks on Side Rod Brasses	Remarks for Imm^dte Cons'n? Observat^n Date	Date Complied with

FIG. 6

Main Overhauls.

All main overhauls are carried out in the workshops, which come under the writers' supervision. Unlike the main line railways, locomotives are not shopped on a scheduled mileage basis, as the relatively limited facilities and pit room available, together with the daily traffic demands, would not permit such a scheme.

In view of constant and sometimes heavy overloading, which unfortunately cannot be avoided, the rapid rate of boiler wear experienced more or less controls the frequency of main overhauls, as its condition (by statutory requirement and otherwise) determines when a locomotive should be withdrawn from traffic for repairs. Immediately a locomotive has been stopped, a survey is made of its condition, and all necessary and outstanding repairs and renewals are put in hand concurrent with the boiler work, if any. From experience, it has been determined that the effective life of the more important component parts which need renewal or servicing from time to time, can be anticipated with a reasonable degree of accuracy. Bearing this in mind, an effective overhaul programme can therefore be drawn up each time a locomotive is stopped by ostensibly any one, or more, given defect. In this way, overhauls are carried out virtually on a semi-scheduled basis, but with more latitude than a programme which determines the locomotives withdrawal from traffic under strict time or mileage conditions, irrespective of the fact that it is still in running order.

The average periods between renewal or reconditioning of the main components are given below. These represent general wear and tear conditions only, and are based on an average working year of 2,500—2,700 hours, or approximately 5,500 miles:—

(1)	Renewal of boiler shell (steel) and firebox (copper)	20—25 years.
(2)	Cylinder boring and renewal of piston heads and rods	15—20 years.
(3)	Refacing of slide valve seats and renewal of valves (cast iron)	15—20 years.
(4)	Initial patching and subsequent renewal of firebox patches (copper). (Side and tube plates, etc.)	7—10 years.
(5)	Renewal of boiler tubes (full set) (brass) ...	6— 7 years.
(6)	Renewal of locomotive tyres (Class C steel) ...	6— 7 years.
(7)	Renewal of big-end, small end and coupling rod bearing brasses (Split type brasses—cotter adjusted)	6— 7 years.
(8)	Renewal of axleboxes	6— 7 years.
(9)	Tyre turning (back to profile)	2— 3 years.
(10)	Renewal of big end, small end and coupling rod bearings (Solid bush type)	2— 3 years.
(11)	Renewal of copper ferrules between tubes and firebox tubeplate (Full set)	1— 1½ years.
(12)	Adjustment of big end, small end and coupling rod bearings (Split/cotter type)	3 months.

Other routine overhauls, such as to the brake rigging, brake-block renewal, bearing spring renewal, adjustment of motion bars,

GENERAL PARTICULARS OF LOCO. BOILER SHELLS, FIREBOXES & TUBES ETC. AS ON ..... AS GUIDE FOR MAINT^NCE PROG. .... COMPILED .....

Locomotive & Date of Purchase of Same	Boiler Shell Particulars 20/25 Yrs			Firebox Particulars say 20/25 Yrs Life			Tube Particulars say 7 Yrs. Life			General Remarks regarding Boiler Components etc.
	Date Fitted	Age to Date (Years)	Estimated Remaining Life	Date Fitted	Age to Date (Years)	Estimated Remaining Life	Date Fitted	Age to Date (Years)	Estimated Remaining Life	

FIG. 7

Operation and Maintenance of Steam Shunting Locomotives—continued

crosshead slippers, grinding in of steam valves, etc., are all done as and when required, but opportunity is always taken to work them in when a locomotive is stopped for other main repairs.

Adequate facilities are provided in the Authority's workshops for all the above items of overhaul, although new boilers are always purchased and kept in stock sometime previous to their anticipated requirement.

Foundry prints of all non-ferrous castings, such as steam manifolds, bearing brasses, injectors, etc., are catalogued and coded so that adequate stocks can be maintained by the Stores Department of the Authority in as simple a manner as possible. A typical catalogue sheet is shown in Fig. 2.

Maintenance Recording.

A maintenance system, however good, falls down if it is not applied at exactly the right time. For this reason, an efficient means of recording a locomotive's life history is essential. Such a system can be applied quite simply, and if the necessary records are compiled at frequent intervals, only a minimum of time need be spent in keeping it going. For interest, the system followed by the writers is described below:—

The disposition of all steam locomotives is recorded from day to day on a monthly sheet (Fig. 3). Boiler washout dates are recorded on a separate sheet in a monthly column against each locomotive, so that the position can be seen at a glance.

At the running shed, separate locomotive cleaning and tube brushing registers are maintained by the Foreman, who controls the periodicity of these operations. Each locomotive has its tubes cleaned twice weekly and receives a thorough clean at least once each week at shed.

As soon as a locomotive enters the workshops for some specialised repairs, all leading particulars of the repairs entailed are entered on to the form shown in Fig. 4. The appropriate " rapid appreciation " sheet (Fig. 5) is then consulted, which shows at a glance what other work is theoretically due. A general survey of the locomotive is concurrently made at the shops, when the overhaul for which the locomotive was stopped, together with any other work due or required is put in hand. In this manner, the " anticipated " repairs are confirmed by practical examination and nothing is left to chance.

So that the mechanical and boiler condition of the whole fleet of steam locomotives can be reviewed at a glance, two large tables (Figs. 6 and 7) are compiled once yearly. These are very useful for reference when planning maintenance ahead, especially with a view to deciding how many new boilers should be ordered, with an eye to the immediate future.

Close study of the " Rapid Appreciation Chart " (Fig. 5) will indicate the value of this sheet for making a quick assessment of the general condition of a locomotive. The age of all the existing main components can be seen at a glance without referring to columns of dates. In addition, the life in years of all previous components can be read off, the renewal dates anticipated with a fair degree of accuracy. In practice, the vertical columns are coloured differently from one another.

Reference to the chart shows the life of all previous components renewed in black, and of existing components " hatched."

New Hongkong Fire Float

Dual Purpose Vessel of Modern Design

By JOHN GRINDROD, B.A. (Com.)

Claimed to be one of the largest and most modern of its type, a new steel, twin screw, motor fire float, named the " Alexander Grantham " in honour of the present Governor, has been completed by Hongkong and Whampoa Dock Company Limited, at its Kowloon dock, to the order and design of the Hongkong Government, and under the special survey of the Hongkong Government Marine Department. The " Alexander Grantham " is to be based on the port of Hongkong.

Although the prime duty of the new float will be fire fighting, she is fitted also to undertake towing, nosing and salvage work and can also be used for taking soundings in connection with hydrographic work when necessary. When carrying out the dual operation of fire-fighting and salvaging the fire float is capable of pumping out a vessel flooded during fire-fighting in order to render her safe for salvage work.

Some 127-ft. 8-in. in overall length, 120-ft. waterline length, 29-ft. breadth main deck and 13-ft. moulded depth, the " Alexander Grantham " is fitted with five Paxman diesel engines each capable of developing 400 b.h.p. at 1,000 r.p.m. Three of these engines, of the 12 R.P.H.Z. type, are fitted in the pump room and each is connected through a flexible coupling to a Merryweather latest type marine pattern four-stage centrifugal fire and salvage pump having casings and impellers of gun metal with manganese bronze shafts. The other two engines, of the 12 R.P.H.M. type, are fitted in the main engine room and are available alternatively for propulsion or for pumping.

When used for propulsion the engines drive bronze propellers of Scimitar design through oil-operated reverse 3 : 1 reduction gear boxes with flexible couplings arranged between engines and gear boxes. A thrust block is incorporated in each gear box, which is complete with self-contained lubricating system. The stern tubes are oil-lubricated and the vessel has a speed of 12½ knots.

For driving the two additional Merryweather fire pumps mounted in the main engine room a power take-off through a flexible coupling is arranged from each reverse reduction gear, each power take-off having a ratio of 1 : 1. To eliminate the possibility of a fire pump and propeller being operated at the same time an oil-operated isolating clutch interlocked with the normal reverse gear control is incorporated.

Motor Firefloat *Alexander Grantham* on trial trip.

Arranged for air starting and fresh water cooling, all the engines have the following engine-driven pumps and accessories: fresh water circulating pump, salt water circulating pump, lubricating oil pump, lubricating oil cooler, lubricating oil filter, fresh water heat exchanger, exhaust silencer, exhaust thermometer, thermometer and pressure gauges for the lubricating oil and cooling water system and tachometer.

Electricity for all purposes, including lighting, air conditioning and operating an electric capstan, is supplied by two Crossley 60 b.h.p. diesel engines, each driving a Clark Chapman compound wound marine pattern generator giving 35 k.w. at 220 volts D.C.

In addition to the engines installed, a spare will be kept ashore. The replacement of any engine will be facilitated by conveniently placed built-in lifting gear and hatches.

The total pumping capacity from all five pumps is 10,500 imperial gallons per minute at a delivery pressure of 90 lbs. per square inch at 700 r.p.m., or 7,750 imperial gallons per minute at a delivery pressure of 180 lbs. per square inch at 1,000 r.p.m.

Extending the full length of the upper deck houses, the fire deck carries seven 4-in. Merryweather monitors, the aftermost being on a raised platform. In addition, there are two Merryweather swivelling salvage suction heads each with three 6-in. diameter hose connections, and four Merryweather fixed delivery heads each having three 4-in. diameter hose connections, all controlled by gun-metal valves.

New Hongkong Fire Float—continued

Capable of delivering either water or foam the four forward monitors are connected by separate foam lines to two 500-gallon compound tanks with pyrene foam generators located in the pump room.

For assisting at fires ashore, which are out of range of the monitors, hoses and fittings are carried. Also included in the equipment are smoke helmets, collapsible boarding ladders, manila scrambling nets, stretchers, gas cutting equipment, pneumatic drill, circular saw, electric drill and felling axes.

Telescopic Control Tower

A unique and interesting feature of the new fire float is a telescopic control tower, which can be raised or lowered hydraulically and which is supported from a streamlined structure on the fire deck. Incorporated in the tower is an upper platform upon which is mounted a 5-in. Merryweather monitor and from which a powerful jet can be played downwards on a fire at any point in the upper structure of the largest vessel using the port of Hongkong. Some 7-ft. 6-in. below the top platform is a rescue platform fitted with an adjustable gangway and connected with the deck by a telescopic light alloy ladder. At its lowest position the rescue platform is about 41-ft. above the waterline. When fully extended it is 57-ft. above water.

Incorporated in the structure supporting the telescopic tower is a hose store and funnel for exhaust machinery gases. In the wheelhouse above the hose store are electric telegraphs to pumping and propulsion motors; telemotor control for electric hydraulic steering gear; echo sounding equipment; clear-view screens and loud speaking telephone system to the tower, after deck, motor rooms and office. A projection type standard compass is fitted on top of the wheelhouse. At each side of the latter there is a steel catwalk and bulwark with a hand-operated searchlight.

Excellent modern and air-conditioned accommodation is provided for the two officers, three P.Os. and crew of 12, who live on board, while a casualty room is fitted with two hospital examination beds and dispensary. Generally, all doors and furniture are of steel and all fittings of non-inflammable material.

The " Alexander Grantham " has raised the Port of Hongkong's fire fighting service to a very high standard in keeping with the status of Hongkong as an international shipping centre. The vessel is sufficiently seaworthy to proceed in all weathers, short of actual typhoon conditions, to any part of the waters of the Colony including the outlying and congested junk anchorages. She will also be able to bring hoses directly to bear in support of the land fire-fighting services at any fire along the many miles of waterfront godown and other buildings.

The Man and the Machine

Need for Enlightened Approach to Cargo Handling Problems

By GEO. B. LISSENDEN, M.Inst.T.

There are many statutory rules and regulations in existence to ensure that the plant used in industry is in a fit and proper condition for the various jobs upon which it is to be employed, but the human machine has so far received very little official attention.

For example, since motor vehicles were first invented, a countless number of " Orders " have been issued by the Ministry of Transport specifying how these instruments for the carriage of merchandise shall be constructed and used on the Queen's Highway, but no test of eyesight is required by the applicant for a driving licence, nor are the myopic compelled to wear their glasses when driving.

Similarly, the Docks Regulations, 1934, prescribe the " manner of test and examination before taking lifting machinery and gear into use ", and enjoin dock authorities to do this and that to ensure the safety of " persons employed in the process " of cargo handling. But here again, nothing is said about the general condition of the workers themselves.

In short, there is no law governing the mental and physical fitness of the man for the job.

Admittedly a start has been made with regard to seamen. Before a man can be graded " A.B." he must now pass the test laid down in " The Merchant Shipping (Certificates of Competency as A.B.) Regulations, 1952." And there are one or two schools for teaching seamanship. For example, there is one in Liverpool where youths are taught, with the aid of models, how to read the compass, take lead-line soundings, and so forth. But something more is required, it is submitted—especially for those who are to be engaged in the loading and unloading of the vessels.

Many accidents to both people and property occur through want of knowledge as to what exactly should be done in given circumstances, and in the interests of all concerned that ignorance should be removed.

Cargo-Handling an Art.

Cargo-handling is an art. Let us be quite clear about that. As much skill—scientific knowledge, that is to say—is required to stow a ship to ensure her stability, her sea-worthiness, as to navigate the vessel while she is on the voyage.

All sorts of wonderful instruments have been invented to assist the navigator in his task—direction finders, echometers, radar, and what not. But the docker is not so well equipped; he gets little or no warning if a sling, unexpertly placed, slips and the load falls down on top of him. The hatchman may shout, " Look out, there! " or " Stand from under! "—but often enough the warning is too late and there is another hospital case.

To have to learn dock work by trial and error—as has been largely the case hitherto—is not good enough for the modern world, and one would be glad to hear that the Transport & General Workers' Union refused to admit any new entrants to the calling unless and until the applicants were fully qualified by training and examination to perform the tasks which would be allotted to them.

Something is already being done in this connection, it is true; here and there young men are encouraged to study the art of weight lifting so that they do not strain themselves, how best to rig a ship for cargo-working, how to splice a rope, drive a winch, make up a " sling " of different commodities, and all the rest of it.

It is also being explained to a few of the ambitious what is the purpose of the rules governing the appointment of a master stevedore, and why the Docks Regulations were issued by the Home Office in 1934. But the practice is not universal, as it must be if our imports and exports are to be handled as they should be, and the dock workers placed in a position to do their job properly without injury to themselves.

It is sometimes said that dockers are conservative, and resent the introduction of new machinery, but they are not alone in this. This was amusingly exemplified during the last war, when a new method was introduced in the Bromborough Dock for discharging cargoes of scrap steel from the United States of America by means of powerful magnets attached to the five-ton electric cranes. A deputation of officials came over from Liverpool to see what was being done, and immediately raised a number of objections until they were told that the magnets had been purchased specially for the purpose, and that it was the usual method of handling scrap steel in the States. To man-handle the cargo would have been out of the question: it comprised everything from safety razor blades to press-packed bales of jagged bits and pieces. As every stevedore knows, under to-day's working conditions, there are some jobs to which old fashioned methods cannot apply, and that was one of them.

Unfortunately, however, there are still many cases where all the stevedore and his men can do is to make the best of the outdated plant provided for their use.

Madras Port Extension Scheme.

The Government of India recently sanctioned a Port Extension scheme which is estimated to cost about Rs. 6.36 crores. The plans include the construction of a new wet dock to accommodate four ships, two reinforced concrete jetties providing three new berths, warehouses, a coal yard and quarters for the staff. The construction of the jetties estimated to cost about Rs. 1 crore constitutes the first stage of the scheme, and tenders for these structures have been received and are now being examined.

Another good job done at less cost than before!

Versatility pays—and here's the new Ferguson Industrial Tractor to prove it . . . doing a job normally needing much heavier, more expensive machinery! One man and one tractor can do dozens of different tasks a day—and, in doing them, slash your costs, for this Ferguson with its range of implements, works quickly, easily, economically! See, for example, how it speeds all these jobs . . .

- ★ All types of haulage.
- ★ Post hole digging.
- ★ Shunting trucks and wagons.
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Remember this, too—the Ferguson is real value. One all-inclusive price covers: built-in fingertip hydraulic control, power take-off, two independent brake systems, hinged mudguards, safety starter, spring-loaded bumper, tipping seat, lights, horn, and driving mirror.

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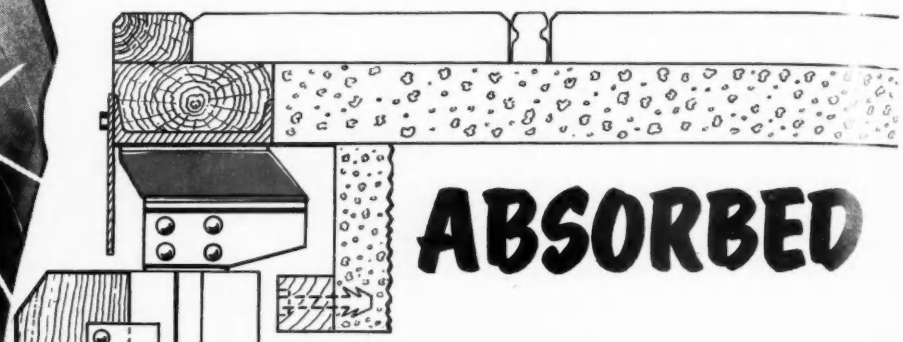
Powerful, yet economical, the Ferguson Industrial Tractor is exceptionally light on fuel (petrol, vaporising oil, or diesel models). On every job, from haulage to belt-work, the smooth running Ferguson engine keeps costs down to a minimum.

Consult your nearest Ferguson Dealer; or write direct for further details to Massey-Harris-Ferguson (Sales) Limited, Industrial Tractor Division, Coventry.

Ferguson in Industry

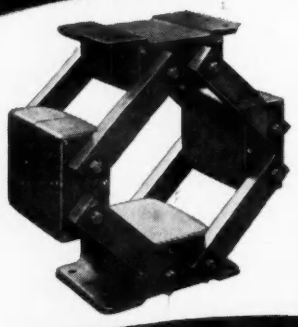
Ferguson tractors, sold by Massey-Harris-Ferguson (Sales) Ltd., are manufactured by The Standard Motor Company Ltd., Coventry.

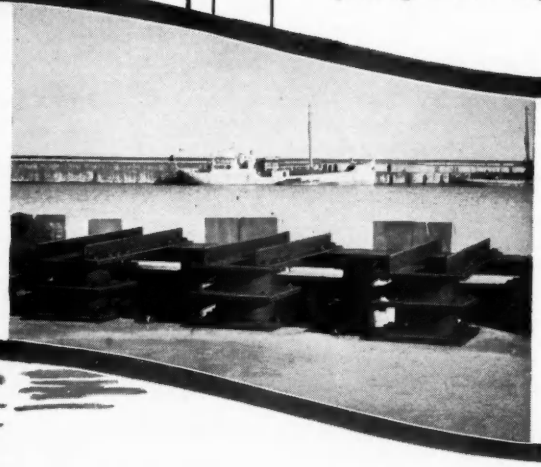


ABSORBED

Andre rubber-metal bonded springs are designed to absorb very heavy shock loads such as are encountered by the fenders on jetties and wharves. These springs take the form of "sandwiches" in which the rubber is bonded to a top and a bottom metal plate. One plate will move relative to the other under shock conditions to a maximum of 45°. A spring in which the rubber is 9" in diameter by 3" thick will absorb energy of 6 inch-tons when deflected 45°, while one measuring 21" diameter by 6" thick has a maximum energy absorbing capacity of 75 inch-tons.

The springs can be employed in series or in parallel, depending on the energy absorption required.





Centre: A view of the fenders at the Dover Harbour Board's Car Ferry Terminal showing how the Andre springs are fitted in pairs, one on top of another.

Left: An Andre-Neidhart fender pile spring unit. A number of these units which take loads in any direction and have a very high energy absorption have been fitted to The Regent Oil Co's Coaster Jetty, Canvey Island. (*Consulting Engineer: J. H. R. Haswell, B.Sc., M.I.C.E.*)

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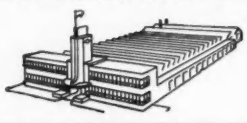

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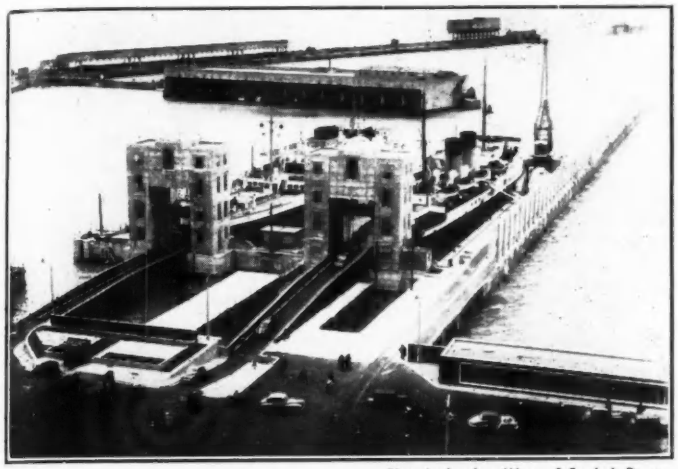

Photo by Lambert Weston & Son Ltd., Dover

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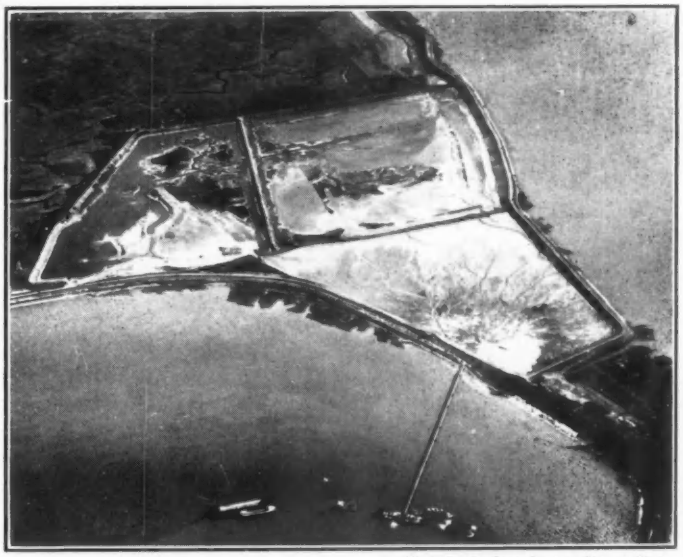

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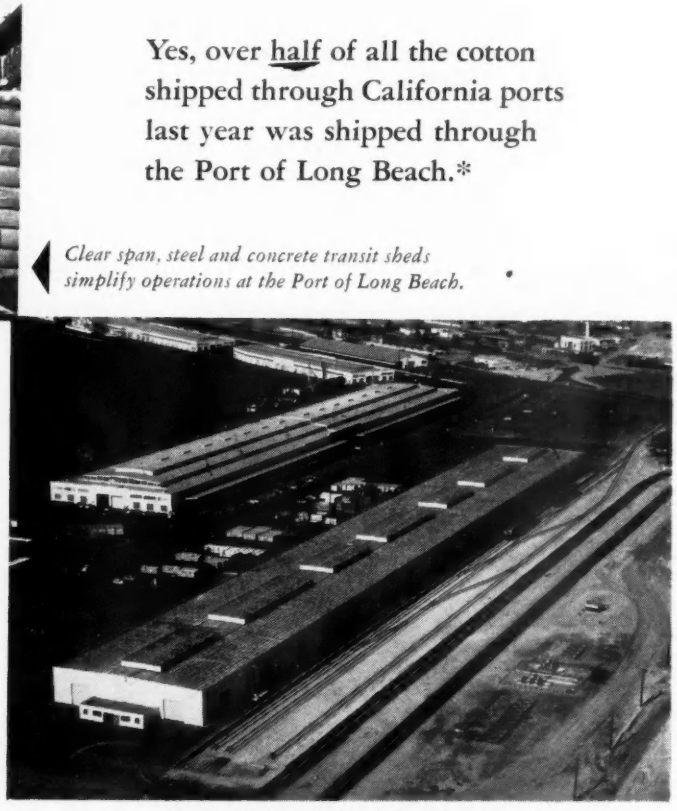

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THE PORT OF LONG BEACH

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Yonderberry Point Jetty, Devonport

Design and Construction

By D. H. LITTLE, B.Sc., A.M.I.C.E.

THE primary function of the jetty is to receive oil tankers. As such the berthing head has only to be capable of withstanding berthing impacts and moored static pulls and only large enough to accommodate header pipes and manifolds. No heavy cranage facilities are required and so the head need not be rigid while the approach has only to carry the pipe lines and provide walking access for personnel with width enough to take a hand cart.

Although the normal usage is expected to be by smaller tankers it was decided that the jetty should be capable of receiving what are commonly termed "mammoth tankers" necessitating 37-ft. of water at low tide. This requirement governed the general position of the head and in order to keep dredging to a minimum resulted in an approach 800-ft. long. A 32,000 ton tanker is 665-ft. long by 86-ft. beam by 35-ft. summer laden draft.

The exact spacing and orientation of head and dolphins were agreed with berthing and navigation officers leading to a final lay-out as Fig. 1. It will be noted that the two extreme dolphins are for the largest tankers and, as will be explained later, these were eventually omitted on the grounds of economy and on the understanding that they would be provided subsequently when definitely wanted.

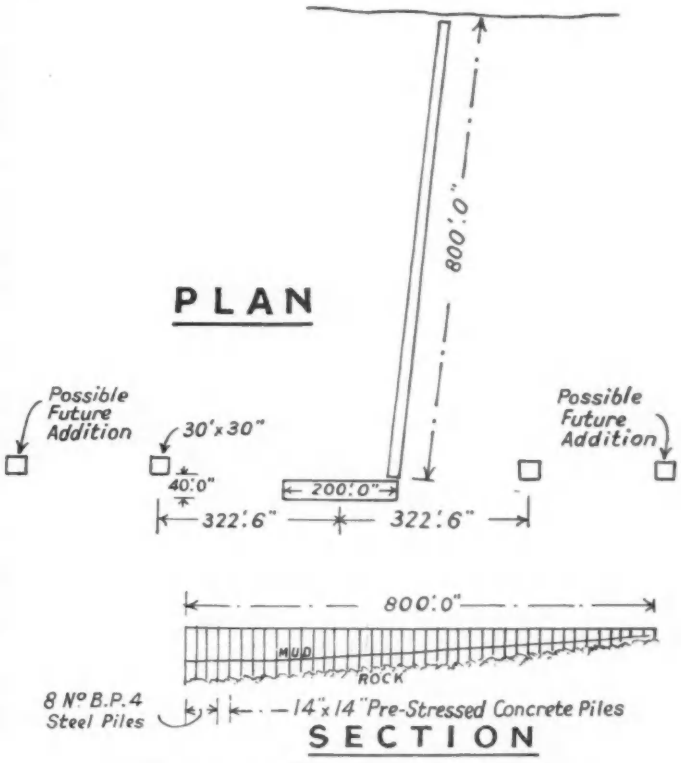
The preliminary design prepared for estimating purposes consisted of vertical steel box piles throughout, capped by flat thick slabs containing hidden beam systems, the approach slab being 12-in. thick: the berthing head 2-ft. 6-in. and the isolated dolphin 3-ft. 6-in. Main fendering is on the head only and this was to have been four groups of steel box piles supported at the deck by large bonded rubber sheer units arranged in series.

It was estimated that the cost of such a jetty would be £150,000 and this sum was eventually approved. As the total area was 25,600-ft. super the average estimated cost works out at £6 per sq. ft., but perhaps a better breakdown would be:—

Approach	16,000-ft.²	@ £4	= £64,000
Head	6,000-ft.²	@ £8	= £48,000
4 No. Isolated Dolphins ...	3,600-ft.²	@ £10	= £36,000

By the time final drawings were completed on this basis, however, the steel shortage of 1951 arose. As it then was, the design involved 900 tons of steel box piles and it was felt that some difficulty would be experienced in trying to justify such a demand. Accordingly pre-stressed concrete piles were substituted in the approach and ordinary reinforced concrete piles in the berthing head and the dolphins. In the approach most of the piles were short and in any case loads were not high so the same flat slab sufficed and solid piles 14-in. x 14-in. were quite adequate. With concrete piles in the head and the dolphins, however, it was no longer possible to take horizontal pulls by vertical piles in bending, so raking piles, with piles raking across the line of berthing and along it, had to be incorporated with a certain amount of modification to the deck slabs. Some of the piles would have been nearly 100-ft. long and quite heavily loaded necessitating an 18-in. octagonal cross section. In order to reduce weight they were designed to be hollow but even so individual pile weights of 12 tons were involved.

This design was fully completed and competitive tenders invited. When these were received it was apparent that a jetty built like this was going to cost £275,000 in lieu of the £150,000 approved and the whole project had to be deferred. But although no construction work could be started the possibility of building the jetty by departmental labour and plant was investigated by Mr. A. E. Chatterton, Civil Engineer Manager, H.M. Dockyard, Devonport, in October, 1952. He concluded that if the design could be restored to vertical piles only and if the approach could be amended to pre-cast units of weights to suit the particular plant he had available, then he could build the berth for £150,000 provided only two dolphins instead of four would suffice. As soon as the steel shortage eased, therefore a design with vertical pre-stressed concrete piles in the approach and vertical steel box piles in the head and two dolphins was prepared and has been built by departmental labour for a nett cost of £115,000. To this figure perhaps £15,000 should be added for overheads and supervision and another £20,000 to cover some of the special floating plant facilities made available by other dockyard departments, giving a gross total of £150,000. The original scheme, therefore, with four dolphins was probably underestimated at £150,000 and £175,000 would have been more appropriate. It is only fair to emphasise that the design tendered for by contractors at £275,000 was very different from the one actually built but these two prices do demonstrate that designing for a particular material economy may result in a much greater monetary expenditure.



GENERAL LAY-OUT — Fig. 1

In all designs the following basic data were used:—

Bollard Pull	65 Tons for all dolphins and each end of the berthing head.
Main Fender Capacity ...	1,000 Inch Tons for each of the four fender blocks.
Bending Stress in Steel Box Piles	7½ tons/in.²
Compressive and Tensile Stress in Cold Worked Bars	27,000 lbs./in.²
Ultimate moment of Resistance of 14-in. x 14-in. Pre-stressed Concrete Piles ...	60 Tons feet.

The individual fender capacity is based on half the weight of a 40,000 ton vessel (i.e. 20,000 tons) striking with a velocity of ½ foot/

Yonderberry Point Jetty, Devonport—continued

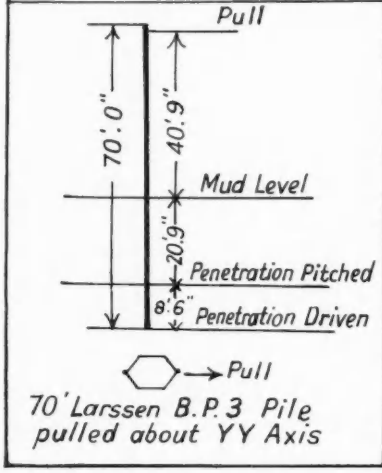
Pile Detail	Pull Tons	Deflection Inches
	½	3 Inches
	¾	6
	1	8½
	1¼	11
	1½	14
	1¾	17
	2	20
	2½	25½
	0	1½

Table I.

sec. On this assumption strictly only two fenders are required so that the vessel's bow may strike one and then the stern swing round and strike the other. Because of the length of the berth, however, and to give a factor of safety, four main fenders were provided.

Fairly hard shale rock (known locally as "shillet") outcrops along the shore sloping evenly down into the main channel and covered with soft silt varying in depth from 38-ft. to only 7-ft. at the North dolphin. Concrete piles could not be made to penetrate the rock but the steel piles were driven in as much as 7-ft. As all lateral stability was to be derived from the bending strength of vertical piles it was essential that these be "fixed" in the ground.

Preliminary test piles were driven to prove the depth of the rock and horizontal loads were applied to one of these (70' B.P.3) at a distance of 40.75-ft. above mud level the pile being 29-ft. into the mud. The results are given in Table I and show that up to the elastic limit of the pile in bending the point of fixity appears to be about 5-ft. below the top of the mud. This accords with general Admiralty experience where mud is at least 15-ft. deep but as a penetration of only 7-ft. into the rock was all that could be obtained when the North dolphin was actually being built and as there was only 7-ft. of mud overlying the rock, a lateral test on two piles was carried out by pulling one against the other. They were B.P.4 piles 70-ft. long driven by a 10 B.3 hammer and the lateral load was applied 6-in. below the top or 55.5-ft. above the mud level. Results are given in Table II and indicate complete fixity 7-ft. below the mud, i.e. at the surface of the rock. A cross section through the dolphin is given in Fig. 2, and if it could be seen as a free standing structure clear of all water it would probably appear a somewhat slender anchorage for a 40,000 ton tanker.

Basically the berthing head (Fig. 3) is similar in design to the dolphins, i.e. strong steel piles are fixed in the ground and in a thick R.C. deck. But as the head is so much larger more piles contribute to a single pull or impact blow. Hence the bending per pile is less and the slab need be only 2-ft. 6-in. thick instead of 3-ft. 6-in. Theoretically the whole head could deflect 6-in. without overstressing the piles and when it was decided to use concrete piles in the approach it was considered advisable to allow the head to deflect freely without thrusting onto the approach. Accordingly a gap of 6-in. has been left between head and approach. Large blocks of rubber are housed in the gap (but only because they happened to be available from another job) and for access purposes the gap is bridged by chequer plating secured to the approach and free to slide on the head. To date the maximum recorded differential movement at the gap has been under 1-in., which indicates that both head and approach are quite rigid enough. This is rather interesting because the approach becomes very slender towards the head with 14-in. x 14-in. pre-stressed concrete piles 80-ft. long resting on the rock in some 25-ft. of mud and a free length of nearly 55-ft. between deck and mud.

Each main fender unit (Fig. 4) is a large T shape block of reinforced concrete weighing 42 tons in air suspended horizontally from the underside of the deck and free to swing backward 4-ft. and upwards nearly 3-ft. thereby doing 1,000 inch tons of work—allowing for partial buoyancy. Previous similar blocks on three other jetties had been suspended either at two or four points and had only been able to recede backwards through guides, i.e. movement along the length of jetty had been deliberately restricted. They had been designed for use with heavy floating fenders which provided some degree of longitudinal resilience but as the Yonderberry fenders were mainly for oil tankers floating fenders were precluded and the blocks were therefore suspended at three points with sufficient clearance from all piles to allow of them swinging and twisting in any direction—along the head as well as at right angles to it. So that the blocks should not be too lively and responsive to choppy water the three suspensions were formed of pairs of chains fastened to two plates in the deck spaced 4.5-ft. apart and coming down in V shape to a common eye on the fender. When pushed back square to the head all six chains share the load but with longitudinal swinging at least two chains go slack and as the block returns these may take up their load again with a sudden snatch. To prevent this, heavy rubber compression springs were inserted in each chain. These compress 4-in. under a load of 50 tons, so, for square movements bringing all six springs into action the added energy is 600 inch tons making a gross total of 1,600 inch tons for each fender as a whole.

Yonderberry Point is less than ½ mile across the channel directly opposite Devonport Dockyard. When it was decided to build the jetty departmentally that meant that all labour and plant would be based on the Dockyard and it became a fundamental consideration that as much work as possible should be prefabricated in the Yard. The fender units were made there and taken across with a 50 ton floating crane; so were the main shuttering for head and dolphins; and the pre-cast beams and slabs for the approach. In some ways the latter is the most interesting feature of the whole job—certainly its speed of construction was the most spectacular since the time taken on the actual site to build 800-ft. was less than six weeks.

The overall width of the approach (Fig. 5) is 20-ft. Pile bents are spaced at 20-ft. centres and the two piles in each bent are 14-in. x 14-in. pre-stressed concrete spaced at 15-ft. centres. They are capped with pre-cast concrete beams 19-ft. long x 2-ft. 9-in. wide x 1-ft. 9-in. deep with three holes in them—the two outer ones for threading over the tops of the piles and the central one partly to relieve weight and partly to allow of more *in situ* concrete to better bond deck and beams together. For the present

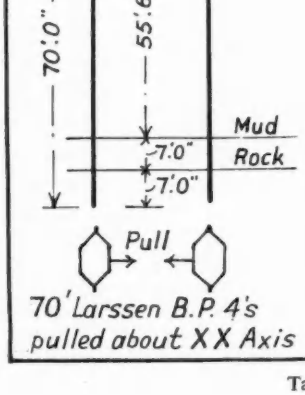
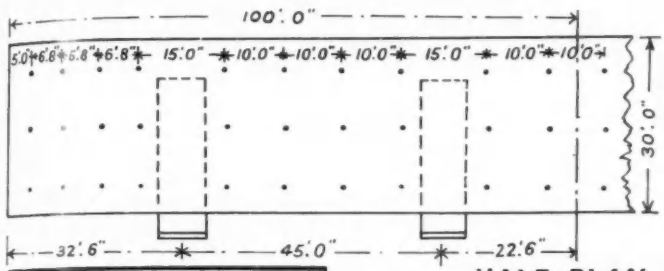
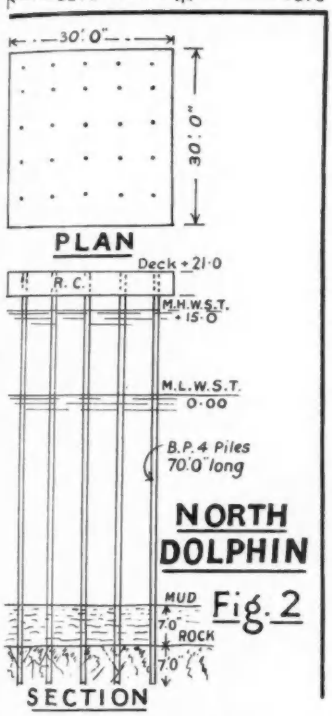
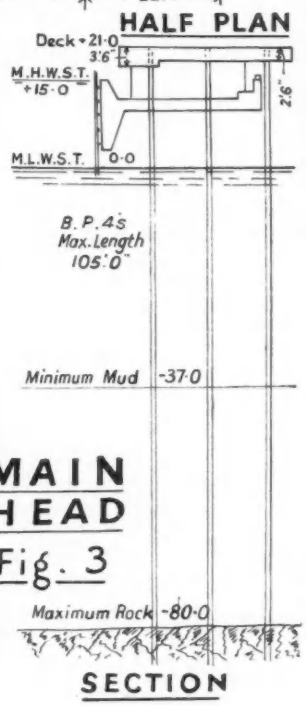
Pile Detail	Pull Pounds	Average Deflection Inches	Number of Readings	Theoretical Deflections
	0	0	0	0
	770	3·6	2	3·5
	1280	5·9	4	5·7
	1770	8·1	4	7·8
	2300	11·0	1	10·2
	2800	13·0	1	12·4
	2300	11·5	1	10·2
	1280	6·5	2	5·7
	0	0·125	0	0

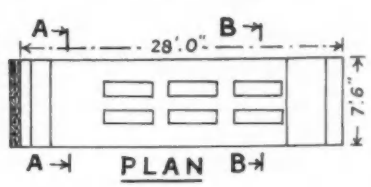
Table II.

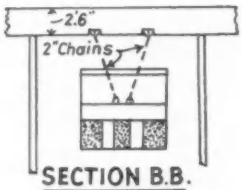
Yonderberry Point Jetty, Devonport—*continued*

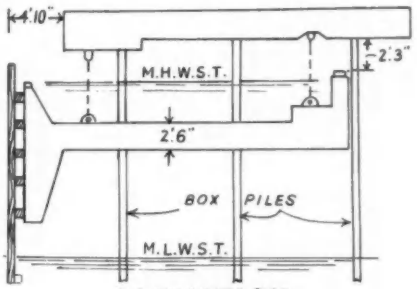


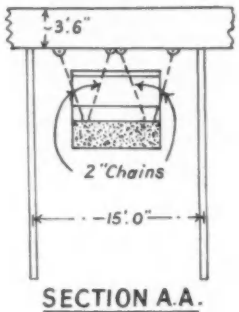




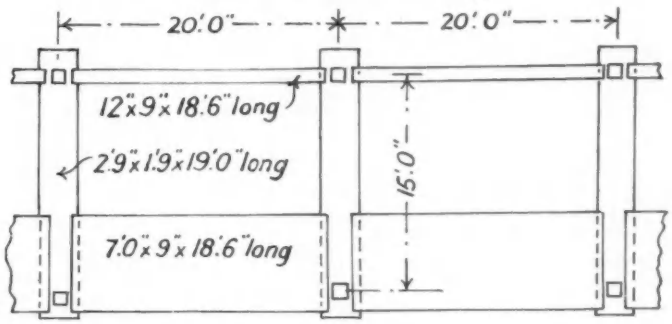


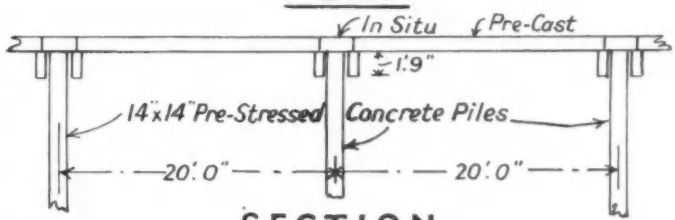






MAIN FENDERS—Fig. 4





APPROACH—Fig. 5

the deck need only be wide enough for foot traffic and precast slabs 18.5-ft. long x 7-ft. wide x 9-in. thick were placed on one side of the cross beams for this purpose—the other side being left open with the oil pipes spanning from bent to bent. A length of 18.5-ft. allowed for 7½-in. bearing on the 2-ft. 9-in. wide cross beam leaving 1-ft. 6-in. for *in situ* concrete. The reinforcement in the slabs projected 1-ft. 5-in. giving full overlaps in the in situ concrete. Although only foot traffic is expected to use the approach, the cross beams and the present slabs have been made strong enough to carry light lorries in case the full width should ever be completely decked.

At the deep water end of the approach the 14-in. x 14-in. pre-stressed concrete piles were 80-ft. long with a free length of 55-ft. out of the mud. In order to stiffen this free end, therefore, the last 85-ft. consisted of a 2.5-ft. thick *in situ* concrete deck supported on 8 No. B.P. 4 Steel Box Piles. By calculation a pair of 14-in. x 14-in. x 55-ft. long concrete piles would deflect 5-in. under a lateral load of one ton whereas a pair of B.P. 4's would only deflect ½-in. It took as long to complete this 85-ft. *in situ* length, however, as all the rest of the pre-cast length but in a review of the whole completed project those responsible for the construction were convinced it was an essential feature.

All the constructional work to the approach, and two dolphins was carried out entirely by a fleet of floating craft, the "flagship," which remained at sea continuously throughout the construction, being a 25-year-old 25 ton steam crane lighter. The piling frame, which was strengthened, was mounted on this lighter. By means of two stern moorings, two bow moorings and two breast wires to new bollards ashore, it was possible to position the craft to enable piles to be pitched and driven to within 1-in. of their correct position in a 2½ knot current. The lighter had to adopt tip and run tactics from the shore end of the approach as the mud dried out at low water. Two old L.C.T.s were used for transporting concrete and steel piles from the Dockyard to the crane lighter. On completion of piling operations these L.C.T.s were converted for use as floating concrete mixing units, each having mounted upon it 2 No. 14/10 concrete mixers and being loaded with sufficient material to produce 50 cu. yds. of placed concrete in one day's operation.

With the type of precast concrete deck used, it was essential that the bent spacing of 20-ft. be accurately maintained and this was achieved by a floating jig fastened at one end and middle to piles already driven and having a "gate" at the other end for the positioning of piles about to be driven. This assisted the skippers of the crane lighters, and the four winch drivers. The cutting of piles to level and the stripping down was a potential bottle-neck as these piles could only be reached from floating craft at high water as at low water they were well out of reach. To get over this difficulty a special cage was devised which was

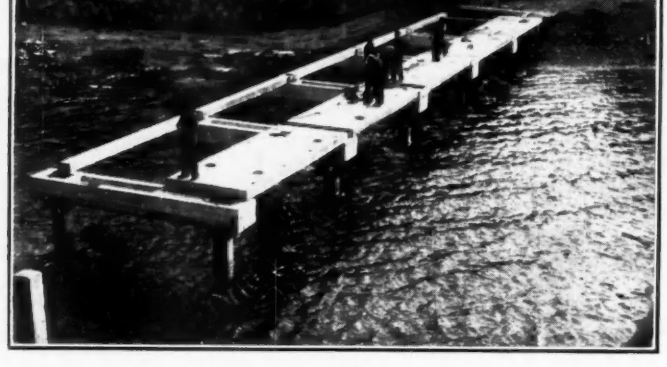
Yonderberry Point Jetty, Devonport—*continued*

Third suspended fender hanging free, temporary platform not yet removed. Temporary platforms removed from first two suspended fenders.

lowered on to a pair of piles by means of the floating craft and clamped into position. Compressed air was led to this cage from a compressor ashore and the two pile tops cut off simultaneously. This operation proceeded while pile driving to the next bent was going on. (See illustration.)

The 25 ton crane was also used to lift the precast concrete cross beams and slabs into position and its somewhat exceptional lifting capacity and radius of action allowed a large area to be covered with minimum adjustment of moorings. In spite of the size of the crane, however, the lop of the water caused it to rock enough for the cross beams to act as pile drivers when being landed on to the temporary brackets fastened to the piles. At first these brackets were simple timber friction clamps bolted on, but the battering action of the 5 ton beams was so severe that additional steel channels secured by explosive nails had to be used. Once the beams and slabs were placed their dead weight was sufficient to ensure adequate temporary rigidity and it was a simple matter to truck out the small amount of *in situ* concrete required from a shore based mixer.

The shuttering for the *in situ* end of the approach 85-ft. x 20-ft. x 2-ft. 6-in. deep was made and assembled as one unit in the Dockyard and then broken down and taken across for reassembling on the piles. Special sliding shuttering was designed for the head, consisting of six units each 4-ft. 2-in. wide x 50-ft. long. These were supported on steel cross channels, running the full width of the head, which were in turn supported on short lengths of channel welded to the steel box piles. Between the sliding units and the steel cross channels there was a 2-in. gap which



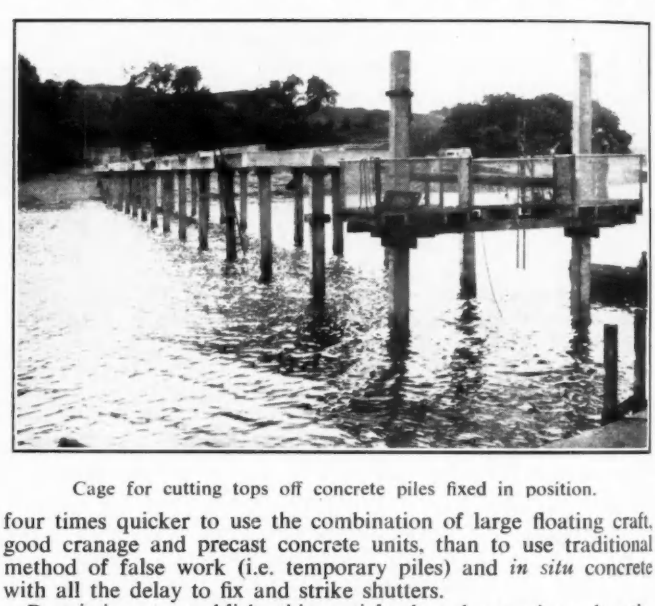
General view of first five bents.

was normally filled by a pair of wooden wedges. On completion of concreting to a 50-ft. section, the wedges were knocked out, the sliding units dropped and were pulled along into a new position 50-ft. along the jetty; they were then pushed up into position again by means of the wedges. On completion of concreting to the head the shuttering was adapted for use on the dolphins.

The 42 ton fender blocks were cast in the dockyard by a berth where the 40 ton crane could be brought alongside, lift them clear of shuttering and transport them direct to the jetty where they were placed in position on temporary walings fastened to the piles —all before the deck shuttering was fixed. When concreting was finished the fenders were lifted up through holes especially left in the deck so that the permanent chain suspension with rubber springs could be fitted.

The total number of piles in the job amounts to 72 No. prestressed concrete, the longest one being 80-ft. and 118 B.P. 4 steel piles, the longest, after lengthening, being 102-ft. The maximum rate of driving steel piles was 7 No. steel piles in one working day. The first pile was driven to the approach on the 29th May, 1953, and the last skip of concrete was placed by Sir Arthur Whitaker, then Civil Engineer-in-Chief for the Admiralty on the 26th February, 1954.

The experience gained shows that construction is about three to



Cage for cutting tops off concrete piles fixed in position.

four times quicker to use the combination of large floating craft, good cranage and precast concrete units, than to use traditional method of false work (i.e. temporary piles) and *in situ* concrete with all the delay to fix and strike shutters.

Permission to publish this article has been given by the Admiralty, but the opinions expressed are the author's.

Dock Facilities at Falmouth.

The Falmouth Docks and Engineering Company are considering a major scheme of development which embodies a drydock extension to provide accommodation for 45,000-ton oil tankers. The proposal is to enlarge the No. 2 drydock, which was constructed soon after the docks company was formed, in 1860, and which has already been lengthened and deepened during succeeding years. The limiting factor, however, has been the breath of the dock, which prevents its use by modern vessels with their increased beam.

To enlarge the dock will involve the excavation of some 180,000 cubic yards of material, the construction of a dam to enable a new entrance to be built, and the altering and re-building of some of the shops and buildings which stand in the path of the projected excavations.

The restricted quantity of land available for the lengthening of the dock necessitates moving its entrance some distance to seaward, and some of the cliff will need to be excavated to enable rail and road facilites to be provided round the head of the dock. It is estimated that the extension will take about three years to complete.

New Shipyard at Lowestoft

Rapid Construction in Pre-cast Concrete

(Specially Contributed)

Brooke Marine Limited was acquired by the Dowsett Group of Companies at the beginning of the second world war and the facilities then taken over consisted of what is now part only of the North Yard, the balance of the North Yard being added during hostilities.

Some three years ago, a scheme for the construction of the new South Shipyard was drawn up, and while certain preliminary work was carried out in November and December, 1953, it was not until January, 1954, that construction proper started.

The Yard has been specifically constructed for shipbuilding by means of prefabrication. It was decided that a 10 ton unit should be worked to as far as possible and in consequence, the cranage capacity is at this figure for the whole of the Yard, with a factor of safety for overloads. A 60 ton electric derrick is being installed at the Engine Quay to permit engining of all vessels at the Yard.

In order to cut down general handling of steel and miscellaneous units coming in to be built into the ships, a general shunting loco crane has been provided, and all rail trucks can pass direct through both the Prefabrication and Engineers' Shops, underneath the 10 ton electric O.H.T. cranes therein, as well as running on special sidings alongside the Main Stores, through the steel yard and alongside the Dry Dock and Wet Dock areas.

The rail lines do not extend out to the building berths proper, and in order to get the maximum of flexibility, 10 and 20 ton rubber-tyred trailers, pulled by tractors on giant pneumatics, will take the units from the Prefabrication and Engineers' shops to the building berths.

A central sub-station and compressor house connected through ducts to tapping points at every working point in the yard eliminate the need for temporary electrical leads and air pipes for welding.

The Yard as a whole has been designed specifically to deal with vessels to an overall length of 280-ft. with a margin to 300-ft. in exceptional cases. Full scale shipyard facilities have been provided for vessels up to these sizes and no waste space or excess capacity in plant is provided for the occasional possible requirements for building larger ships. The ultimate capacity of the steel construction side will be between 12 and 18 vessels per annum, ranging from 200—280-ft. overall length.

General Description of the New Shipyard

The Yard is sited on the South side of Lake Lothing, with direct access to the sea through Lowestoft Inner Harbour, which permits the passage of vessels up to 60-ft. beam and 18-ft. draft. The site occupies about 35 acres which, with the exception of a small area to the North-West used by Brooke Marine for shipbuilding, consisted of tidal flats and marshy ground before construction proper began in January, 1954.

The new layout is planned symmetrically about a centre line running approximately North to South through the site, which constitutes a promontory in the shore line. Ships will be launched upstream and downstream instead of towards the opposite bank. The facilities provided include:—

2 Berths, 225-ft. long by 50-ft. wide, depth of water at end of launchway 10-ft. 3-in. at H.W.O.S.T. on cill, increasing to 20-ft.; designed for building and launching vessels up to 200-ft. in length.

2 Berths, 255-ft. long by 55-ft. wide, depth of water at end of launchway 12-ft. 3-in. at H.W.O.S.T. on cill, increasing to 22-ft.; designed for building and launching vessels up to 230-ft. in length.

2 Berths, 322-ft. long x 60-ft. wide, depth of water at end of launchway 13-ft. 6-in. at H.W.O.S.T. on cill, increasing to 22-ft. 6-in., designed for building and launching vessels up to 280-ft. in length. Also suitable for use as Slipways with 22-ft. 6-in. depth overall at H.W.O.S.T.

To exclude water from the berths and Slipway while ships are being built, floating caisson gates are being provided at the end of each berth. The building berths have bottoms of re-inforced concrete having declivities of 11/16-in. and 13/16-in. per foot.

Wet Dock: With 780-ft. of quay wall available for fitting out, is dredged to a general level of 22-ft. 6-in. and for 280-ft. is designed to be dredged to 25-ft. 6-in. below H.W.O.S.T. The dock will float vessels with a draft up to 12-ft. 6-in. at all states of the tide.

Dry Dock: To accommodate ships up to 300-ft. in length. Keel block level 18-ft. below H.W.O.S.T.

Engining Quay: 260-ft. long, dredged to a depth of 22-ft. 6-in. below H.W.O.S.T.

Workshops and Other Buildings.

The main buildings in the new Shipyard are:—

Prefabrication Shop and Engineers' Shop: Each of these buildings is 360-ft. long by 150-ft. wide, with a central bay 75-ft. wide and two side bays 37-ft. 6-in. wide. The height of the central bays from floor to roof beams is 41-ft. 6-in. and of the side bays is 20-ft. One of the annexes to each of these main shops has an intermediate floor, used to provide a Mould Loft in the Prefabricating Shop, and Joiners and Paint Shops in the Engineers Shop.

Main Stores: Multi-bay, length 56-ft. overall, width 215-ft.

Compressor House and Sub-Station: Length 105-ft., width 28-ft.

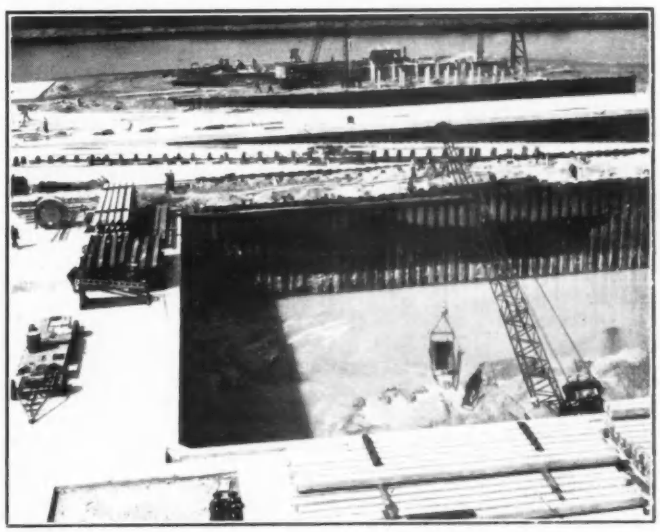
Canteens and Kitchen: Length 161-ft., width 28-ft.

Gatehouse: Including Offices for Gatekeeper, Police, Ambulance and Traffic Control, length 63-ft., width 28-ft.

Inspectors' Office: 28-ft. square.

Main Office Block: 224-ft. long with two side wings each 119-ft. long and a centre wing 84-ft. long.

The Building Berths, Dry Dock, Wet Dock and Slipway are covered by Monotower Electric Travelling Cranes, each capable of a lift of ten tons at a radius of 80-ft. or 6 tons at 100-ft. radius. The Engine Quay is served by a 60-ton derrick; the sidings and shops are also equipped with suitable cranes of from 3 to 5 tons.



View looking north, across wet dock and new building berth.

Civil Engineering Aspects of Construction

The finished level of the top of the quays and throughout the Yard is at a height of 5-ft. above H.W.O.S.T., being designed to give a margin above the maximum flood tides ever recorded. Concreted surfaces are provided to all the quays and berths and to the slipway, and in general to the whole exposed surface of the shipyard, as well as to the floors of the Prefabrication and Engineers' Shops, Stores, Compressor House and Substation, etc.

The principal works of civil engineering involved in the construction of the new shipyard are: the excavation of the berths and docks; the driving of the steel sheet piling forming the vertical walls of the building berths and quays; the tying together of the quay walls with heavy steel walings and tie rods to take the lateral thrust from filling inside and from superimposed loads on the top of the quay; the filling and levelling of the quays and other surfaces to finished levels; the concreting of the quays, dry dock and other level surfaces, and of the sloping bottoms of the building

New Shipyard at Lowestoft—continued

Berth No. 3E (in centre) for building ships up to 280-ft. overall.

berths and slipway; the driving of prestressed concrete bearing piles ranging in length between 20-ft. and 40-ft. required to give sufficient bearing value to take the loads involved in the various parts of the shipyard; the preparation of foundations for the main workshops; the laying of railway lines, and of ducts for the electricity, compressed air, water, storm water, sewage, etc.

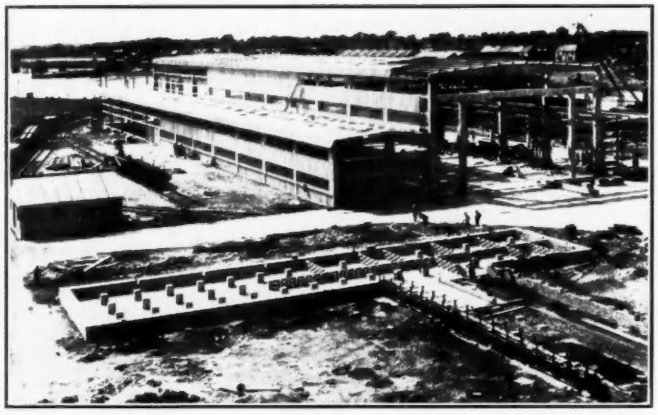
The work has been carried out to a tight time schedule, involving close planning of manufacturing and delivery dates of prefabricated concrete units, co-ordinated with the phased programme of construction on site. Work on the site started during January, 1954, and by January, 1955, 90 per cent. of all civil engineering and building work was completed. This result was achieved with a maximum labour force of 180 men at any one time, and was made possible mainly by the very extensive use of prestressed and precast concrete units.

As already stated, the site of the works was mainly low lying ground. A large area of the land was submerged under the January Flood of 1953, and this factor influenced the design, order and method of construction to a considerable extent, as the lowest excavated level was 27-ft. 6-in. below this flood level in the proposed Wet Dock. Flood protection was therefore a major consideration.

The site consisted of sand varying from coarse to extremely fine with occasional bands of gravel, and where reclamation from Lake Lothing took place up to 4-ft. of mud and clay was encountered.

The water table lay at approximately 20-ft. above the level of the lowest excavation and this called for continuous pumping.

The order of the construction was governed primarily by the necessity of maintaining the existing shipyard facilities with a minimum of interference; by the availability of excavated materials for protection works; by quay construction and building up the low lying areas; and by the need for providing additional berthing and welding facilities for the existing yard at the North West corner of the site before encroaching on and demolishing it.



View looking west, showing prefabrication shop and, in the foreground, the foundations of the main office block.

The bulk of the available excavated material lay in the Wet Dock, there being approximately 50,000 cu. yds. that could be obtained under Phase I of the programme. About half of this could be excavated directly by Scrapers, the remainder being cut by a 37 R.B. Dragline to stock piles left to drain and thence scraped by 2 No. 9 C.Y. Onions Scrapers and Challenger III Tractors.

In order to release this amount of excavation, steel sheet piling to the Wet Dock proceeded at the same time as the scraper work, and the 41-ft. and 45-ft. No. 3 Frodingham and B.S.P. piles driven by 9 B.3 Hammers were driven to an average penetration of 38-ft.

The piles were driven using a No. 20 Spencer Hopwood Boiler mounted on a 60-ft. steel frame and to speed up the work the piles were driven halfway with the steel frame and finally driven with a 37 R.B. with a second 9 B.3 McKiernan Terry Steam Hammer following behind.

For the driving of the steel piles to the first two quays McKiernan Terry Hammers drove the IGB, No. 2 and No. 3 B.S.P. piling with timber trestles and guide walings and No. 16 Boilers. The hammers being slung by either 37 R.B. or 24 R.B. excavators used as cranes.

The piling works proceeded in two 12 hour shifts (11 shifts per week) and driving commenced during the last week of November, 1953, and by April, 1954, 1100 tons of sheet piling, representing the completion of the eastern half of the site, had been driven.

The concrete piles for the Monotower supports, the launchway, supports to the building berths where required, to the main bases of the Prefabrication Shop and Engineers' Shops, were 25, 30 and 35-ft. 12-in. x 12-in. prestressed concrete piles driven by either a 24 R.B. or 37 R.B. with a timber frame or false leaders suspended from the jib. Approximately 750 concrete piles had been driven by November, 1954.

Prestressed and Precast Concrete as a Building Medium

The application of precast concrete at the Lowestoft site covers a wide range.

1. The Prefabrication and Engineers' Shops.
2. Various "Dowsett" standard buildings including the multi-bay type.
3. Prestressed piling.
4. Precast cable and pipe ducts.
5. Prestressed railway sleepers.
6. Prestressed poles and fencing.

The main buildings are the first precast prestressed factory-produced buildings of this size to be erected in this country. This form of construction was adopted against competition by the more conventional forms for the following reasons:—

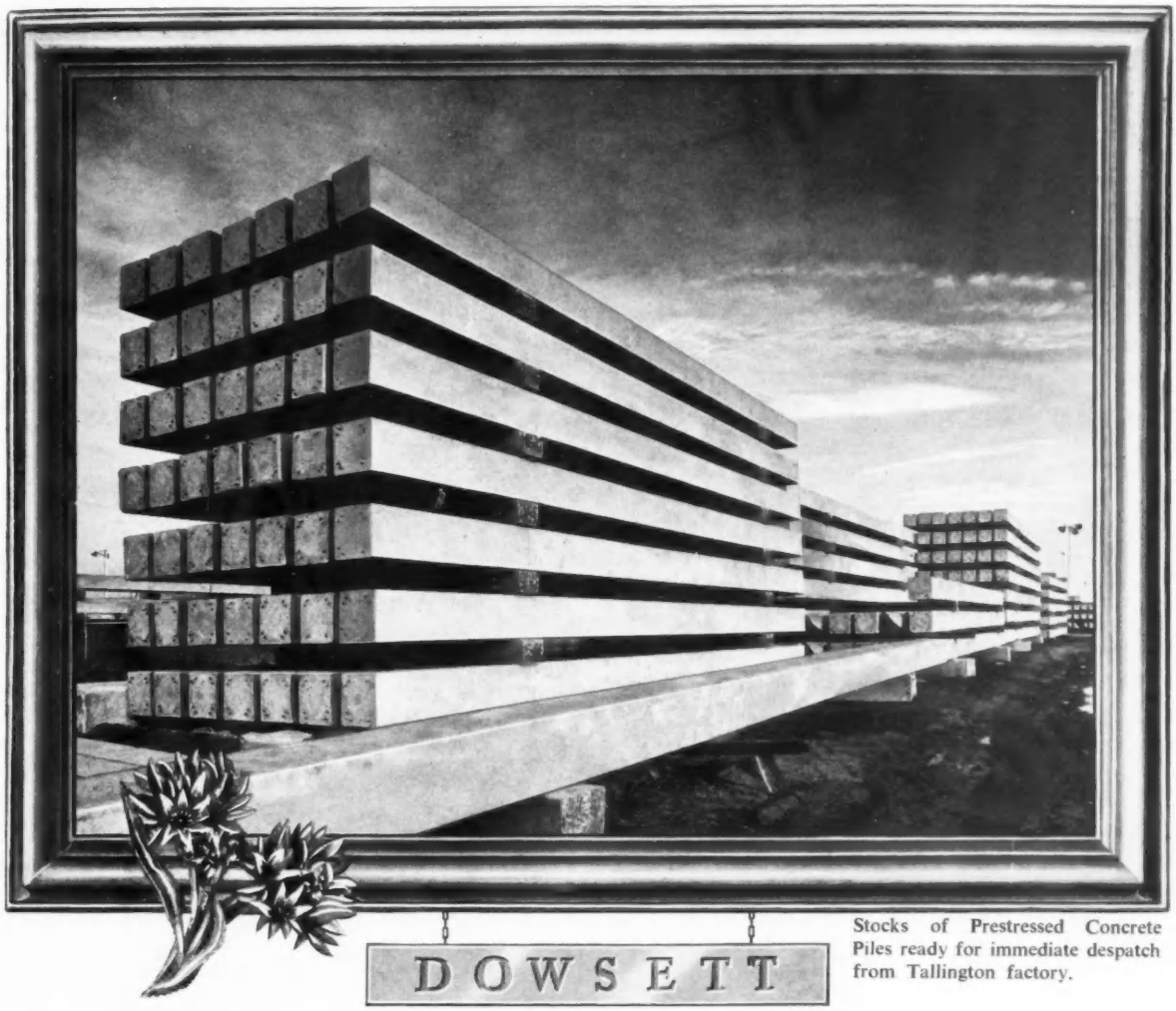
(1) The buildings are free of maintenance—nowhere are materials used which are affected by atmospheric conditions.
(2) Normal decoration is reduced to a minimum as colour can be cast into the facing units to give a permanent finish.
(3) By prearrangement in design, all fixings of units are incorporated in the construction of the unit and where bolts are used provision is allowed for sealing by pressure grouting.
(4) All that is necessary for efficient erection is a centrally placed access, allowing a single crane to handle and erect all the units directly into position.

Prefabrication and Engineers' Shop. These two shops are identical in structural design, although the location of first floors and annexe cranes varies. The type of construction was selected to suit:—

(a) Construction in precast concrete units which inherently would have negligible maintenance costs at a site where deterioration of steel is abnormally quick.
(b) Rapid commencement and manufacture of units with a minimum amount of site work.
(c) Economy in overall cost.

The construction throughout is of reinforced concrete columns with precast prestressed concrete horizontal members in longitudinal and transverse directions of the shops.

(Concluded on page 279)



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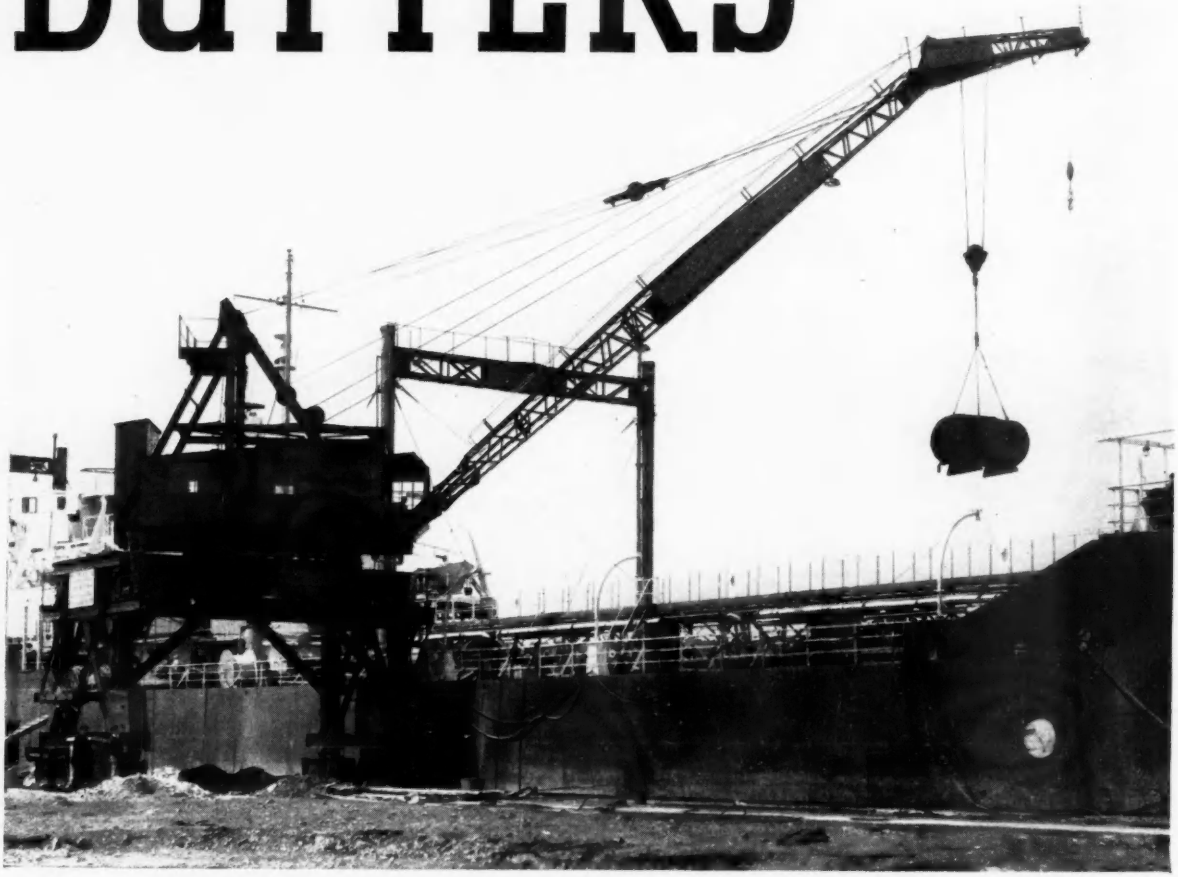

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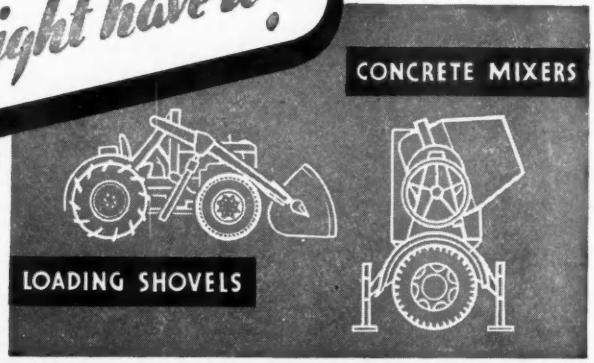

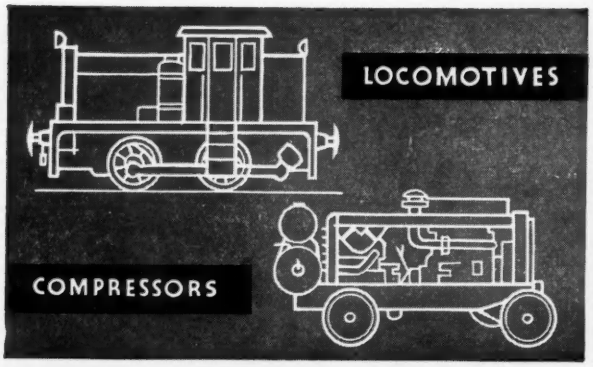

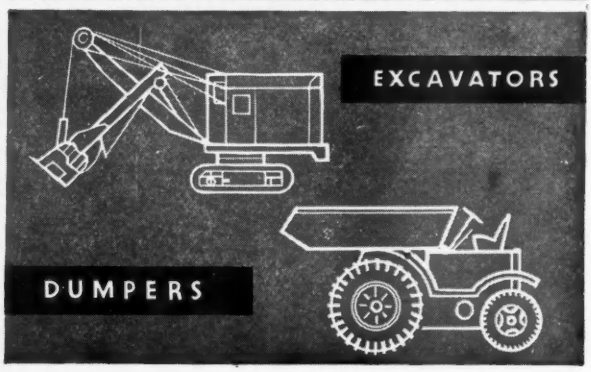

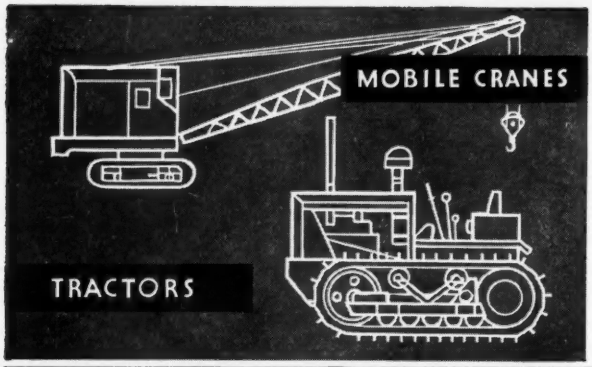

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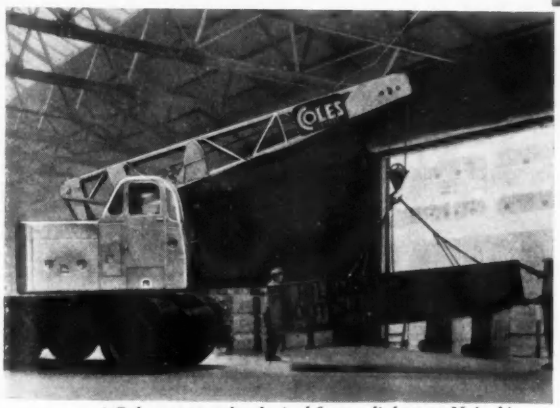
A German-owned Coles crane handles containers at Hamburg Port, and below, a British port using a Coles to lift and carry automobile parts within the transit shed.



A Coles crane unloads sisal from a lighter at Nairobi.
The crane is owned by East African Railways and Harbours.

All Coles cranes have diesel-electric transmission, the system which takes good care of delicate or valuable cargo by giving smooth and precise movement under perfect control. Additional advantages of electrical operation include low maintenance and fuel costs and the absence of fire risk and contaminating fumes—so important in transit sheds. Positive safety devices are built into the system to protect operator and machine from damage.

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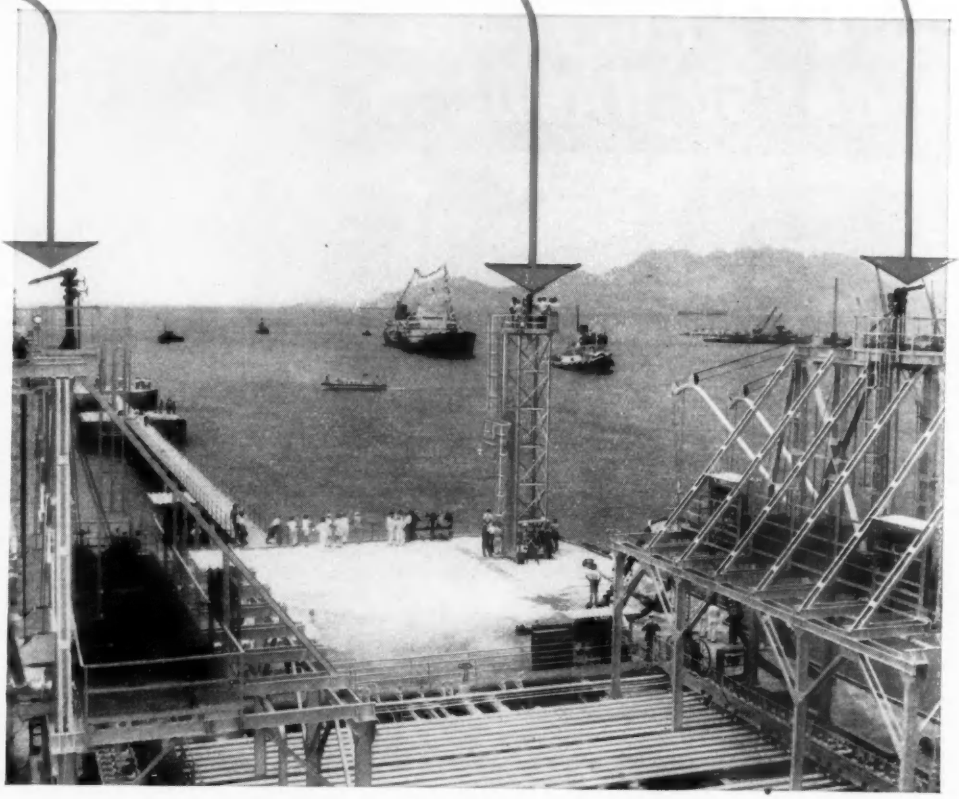
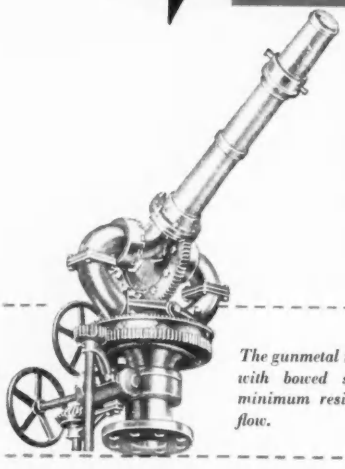


Foamite JETTY MONITORS



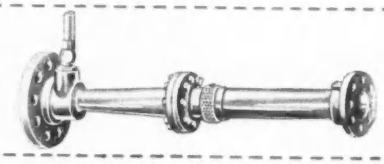
Standing fire guard along the jetty at Aden are the familiar Foamite Foam Monitors mounted on steel towers. Altogether there are 12 of these monitors in this installation spaced at strategic intervals. Three can be seen in the photograph taken on the occasion of the arrival of the first tanker in the harbour.

The monitors point in any direction—elevation and rotation are controlled either at the monitor itself or from ground level—and in the event of fire, they instantly discharge a powerful jet of foam on to the affected area blanketing the outbreak and extinguishing the fire before it has a chance to get a hold.

Photograph by courtesy of The British Petroleum Co. Ltd.

The gunmetal monitor is 4" size with bowed shoulders giving minimum resistance to liquid flow.

Pressure Foam Maker comprising Proportioner (mixing water and air foam liquid) and Aspirator (aerating the mixture)



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Ports and Shipping—Yesterday and Today

Presidential Address to the New Zealand Institution of Engineers*

By N. L. VICKERMAN, D.S.O., O.B.E., M.Sc., M.I.C.E., President 1953-54
(Chief Engineer, Port of Auckland, N.Z.)

(Concluded from page 236)

Dredging Problems and Types of Plant.

The growing size of ships has demanded an increasing depth of water at the berths. This has usually to be provided by dredging. Few ports are fortunate enough to be without this problem, and in the case of river ports there is the continual removal of silt brought down by the river.

Dredging plant has not changed greatly in form during this period, but has increased in size and improved in performance, and dredgers are now used for cutting ground that had previously to be chopped or blasted before dredging.

Development of manganese and other alloy steels, and ability to make very large steel castings have effected improvement in heavily worked parts, giving them a longer life and allowing them to be more heavily loaded. Hard-surfacing with special alloys deposited by electric welding is giving good results against abrasion. Further improvement has been gained by the introduction of sealing devices for heavy bearings, enabling these to be lubricated by oil under pressure and excluding the sand and grit that used to cause rapid wear.

The bucket ladder dredger is still most used where large quantities of ground of varying hardness have to be removed. Changes that have taken place are welded ladders to give increased length without excessive weight, cast steel tumblers in one piece, cast steel one-piece buckets, alloy steel pins and bushes and oil-sealed bearings for tumblers and ladder rollers. Diesel engines are being used with belt drive to the top tumbler.

For reclamation dredging, when the material is free cutting, the cutter suction dredger with floating pipe-line has been developed to very large capacities, sometimes with diesel-electric drive from multiple generator sets, allowing any one set to be taken out of commission for servicing or repair without interfering with dredging.

Sand pumps have been improved in design to give higher efficiency in pumping and easier maintenance. Higher powers are used for the cutter engine, and cutters of various forms are used according to the type of ground being dredged.

Mooring by spuds in conjunction with conventional wire-rope moorings is common. For the floating pipe-line, rubber sleeve joints are used where the angular movement is not excessive, and ball-and-socket joints only where this movement is large.

For dredging approach channels which are subject to siltation or for deepening these where the material is soft, the drag suction dredger has been developed. It can work in strong tides and rough sea that would preclude the use of a bucket ladder dredger, and for these conditions is an efficient plant.

One variation of the suction dredger is the shore discharge plant which discharges and pumps ashore spoil brought to it by hopper barges. This is now a common way of dealing with the material excavated by the bucket ladder dredger, instead of taking it long distances for dumping at sea.

Generally the improvements made in dredging plant have aimed at reducing the unproductive time required for servicing and overhaul. A dredger is an expensive plant to operate, and its only productive time is while actually dredging.

Mention should be made of the grab dredger, one of the oldest forms of dredging plant and one that has been in constant use throughout the years. In its older form it consisted of a steam crane operating a two-chain grab, the winch and boiler being mounted on the revolving bed which also carried a large counterweight operating the holding barrel. Control was by a complicated system of levers operated by hands, feet and elbows. In small self-propelled plants, steam was taken from the crane boilers through the centre kingpin to a very inadequate steam engine in the hull.

The modern grab dredger has a twin-barrel diesel-driven crane operating a three-rope grab and with controls conveniently grouped as in modern crane practice. If self-propelled, it may have a powerful diesel engine for propulsion installed in the hull, and this may drive a generator for supplying current to one or more electric twin-barrel grabbing cranes on deck. It is now an economical plant to operate, and can handle quite large quantities of material.

Tugs.

The growing size of ships has also had its effect on the harbour tug. A ship over 600-ft. in length and more than 30-ft. daught, with only a few feet of water below its keel, is a very big obstruction to a tidal current, and is at times subject to a large tidal force. In addition, such a ship may be 70-ft. or more from water-line to upper deck, presenting a very big surface to the pressure of the wind.

To meet this position, harbour tugs have grown accordingly. Their length has been increased as little as possible because of the need for them to work in restricted spaces, but their engine power and their power to pull or push has grown appreciably. For twin-screwed tugs up to about 1,250 h.p., diesel-powered tugs with direct reversing two-stroke diesel engines are now giving very good service. For tugs of greater power, high pressure steam propulsion is usual, but diesel-electric propulsion is also used where the extra expense of this is warranted.

For the smaller tugs, which are a feature of all commercial ports, the old steam tug and in the smallest sizes the steam launch have disappeared entirely, their place being taken by the diesel-driven vessel of about the same size but of increased power. The petrol engine which was used during the intermediate stage of this change is now seldom used for commercial vessels.

Docks, Slipways, etc.

Most ports have to provide for the repair, cleaning and painting of ships. For this the slipway, the graving dock and the floating dock have all had their place for a long time. The cost of these is high, and increases rapidly with the size of vessel to be accommodated. They are seldom a direct source of revenue to a port authority, but they are a necessary piece of port equipment.

The slipway has changed little in form and is still preferred for small vessels.

The graving dock has advantages for large vessels, particularly when extensive workshops are available at the dockyard. It is, however, expensive to construct unless ground conditions are particularly favourable. In the larger sizes, economy of use and economy of pumping are obtained by using internal caissons subdividing the dock into sections as required.

Dock pumps are now of centrifugal type and generally driven by electric motor. These have replaced the old double-acting plunger pumps of large diameter and long stroke located at the bottom of a large pump well and driven from a horizontal steam engine by a long connecting rod. In those days, maintenance of pump valves was an almost continuous operation.

The floating dock is now very common and is built in all sizes up to the very largest. It is not a new development, one having been built in Port Chalmers nearly 100 years ago. It is usually less costly than a graving dock of equal capacity, and has the

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Ports and Shipping—continued

great advantage that it can be moved from place to place to suit port development or even taken to another port. It can be built in sections which can be detached and docked one at a time for repair or maintenance.

Docks and slipways now supply services of power and circulating water to allow ships to run refrigerating and other machinery, and also compressed air, power and lighting for repair work.

For work under water carried out by divers there are now available appliances and processes that allow of work that had previously to be done in diving bells or coffer dams.

Diving gear, as used for the depths usual in harbours, has altered little in form, but the hand-operated air pump has given place to the engine-driven compressor supplying air to one or more divers. Loud speaking telephones keep the diver continuously in touch with his mates on the surface, sodium and mercury vapour lights in watertight fittings allow him to see where he could previously only feel, and he has the use of many forms of pneumatic tool to assist his work.

Cutting of steel under water is now a simple process, by oxy-acetylene flame in depths up to 25-ft., and oxy-hydrogen flame to 60-ft. For greater depths and for very heavy cutting, the oxy-arc is used. Metallic arc welding can readily be done under water.

Navigation.

A safe harbour has associated with it the problem of providing a safe means for vessels to enter it under all conditions of wind and weather. In this regard there has been remarkable progress.

Lighthouses, lighted beacons and lighted buoys have always been, and still are, the principal methods of marking approach channels, as these are useful to all vessels, whether or not they are equipped with modern navigation devices.

It has been necessary to continually increase the power of these lights because of the difficulty of distinguishing them when approaching from seaward against the background of high-powered city lighting that has steadily grown since electricity came into general use.

The laws of most countries give power to a port authority to prohibit the use of shore lights which may be a cause of danger to navigation, but this power can reasonably be used only in extreme cases, and there appears no practical way of overcoming the difficulty other than by building up the strength of navigation lights and giving them distinctive characters.

The manufacture of optical lenses for lighthouses and beacons had long before reached a very high standard, and there are still in use in this country some fine examples of dioptric and cata-dioptric lenses installed nearly one hundred years ago. The only thing required for these was a more powerful light source.

At the beginning of this period, paraffin wick lights of various types had been replaced by the gas flame. Gas was made from paraffin oil and was stored in large cylinders under a pressure of 90 to 100 lb./sq. in. Lights were either of the open flame type or with incandescent mantle, and they were given a distinctive flashing character by means of a flasher actuated by the gas pressure. The flashing light was not only more distinctive than the continuous burning light but also used less gas. A further economy was made by the introduction of the sun-valve, a simple device operated by the sun's rays which turned off the light during daylight hours.

Oil gas was next replaced by acetylene, which gave a light of higher intensity. Dissolved in acetone under high pressure, the acetylene could be stored in small, easily-handled cylinders, and in this form it is still the most commonly used source of light for buoys and beacons.

For major lights, electricity is now frequently used. The development of the projector-type incandescent lamp, with its filament of small dimensions and high light power, provided a light source ideal for lighthouse work. The necessary reliability was achieved by the introduction of automatic lamp changers to guard against a burned-out lamp and of standby engine-driven generators to take up the load automatically should the first source of supply fail for any reason.

For smaller lights on buoys and beacons, electric light operated from storage batteries or dry cells is now being used, these lights being equipped with flashers, automatic lamp changers and photo-electric-cell sun valves.

With all these improvements, reliability has been a first consideration, and the modern harbour light is an efficient and reliable piece of apparatus requiring attention only at long intervals. Many lights previously requiring a light attendant are now unwatched and visited only at regular intervals for routine servicing.

The radio beacon is a modern aid which enables a vessel to take an accurate bearing under conditions when a light would not be visible. It is, however, a long-range beacon used at the approaches to a port rather than as a short-range harbour beacon. It can be used only by vessels equipped with the appropriate direction-finding apparatus.

Radar is probably the greatest of all modern aids to safe navigation when entering port. A vessel equipped with radar can without difficulty and with great accuracy pick up all navigation beacons and buoys, provided these are of a type that will give a good reflection or are fitted with a radar reflector. It can also pick up any vessel or other object that may be a danger to it, and may do so in darkness, fog or any other conditions.

Many ports are equipped with shore-based radar installations which show on a screen the position of all vessels within range. This is of great value under some conditions, but to get its full value, it is necessary to have a very high frequency telephone service to communicate to the vessel concerned the information shown on the radar screen. Lower-frequency services receive too much interference when radar is operating.

Shore-based radar can be of great service to a harbour ferry service during fog. When ferries are crossing lines of traffic they can be advised continuously by a loud-speaking telephone on the bridge of their exact position and of the position and direction of movement of any vessel in their vicinity. This enables the master of a ferry to proceed with confidence, and allows a reasonable service to be maintained during fog. The one radar installation can conduct two or three vessels simultaneously according to conditions.

Fog signals are an important aid, and development has been towards making these audible for longer distances. To try to achieve this, the explosive signal was produced, this consisting of a series of small guncotton charges fired at regular intervals. The charges were hung by the detonator wires from hooks on a vertical endless chain elevator driven by clockwork. This raised them to the top of a short mast, where the wires touched two electrical contacts, causing the charge to fire (or sometimes mis-fire). The operator, who was housed in a shelter at the base of the elevator, did not look upon this as his favourite pastime, and was generally as relieved as the master of a vessel when the fog cleared.

The explosive signal has been replaced by the horn, comprising one or more trumpet-shaped reed instruments operated by compressed air supplied from an engine-driven compressor. The note given by the horn is longer than that of the explosive signal and the direction of its source is easier to determine. Its operation is certainly easier on the attendant.

Close-range fog signals used within harbours are usually simple bells, sirens, whistles or similar devices operated electrically. These can be controlled by land line from some central point, from which they are switched on and off as required.

Where access is difficult, signals can now be controlled electronically.

Development of the echo sounder provided an instrument that is of value not only to the navigator of a ship but also to the harbour engineer. The continuous chart that it produces showing the depth of water at every point along the line that the vessel is travelling allows a hydrographic survey to be made just as accurately and infinitely more quickly than by the older method of taking individual soundings. This instrument is made in portable models that can be installed in a small boat.

Work of the port signal station has been simplified by these modern inventions.

A continuous watch had to be kept for vessels approaching a port, and when seen they had to be identified and arrangements made for pilot, customs officials and health authority. Under

Ports and Shipping—continued

adverse weather conditions it was not easy to do all this in time to prevent delays. Nowadays a vessel can by wireless advise its position at any time, and all concerned know its expected time of arrival long before it reaches port.

Radio-telephone is used on dredgers, tugs, launches and other floating plant, and these are now in constant touch with the controlling authority. This has done away with much lost time, and allows of better service from this plant.

Effect of City Growth.

Having seen the changes that have taken place in the port as a terminal for commercial shipping, I will mention briefly some of the problems that have been created by the growth of the city around the port.

Trans-harbour traffic has to be provided in most ports, for it is quite usual for residential settlement to grow on the side of the harbour remote from the wharves. This starts as a passenger ferry service from some convenient point near the main traffic centre and later a vehicular ferry service becomes necessary. The introduction of the motor car and the tremendous growth in the number of motor vehicles of all types has imposed a heavy load on ferry services and has created a traffic problem at the points of loading. This has led to a demand for a more convenient means of transport, the alternatives being a road around the harbour, a low-level bridge upstream of the wharves, with or without a lifting span, a high-level bridge where traffic can best be served, or a tunnel under the harbour, the choice depending entirely on local conditions.

It is usual for the merits of each of these to be argued for many years before a decision is made. The port authority is concerned only that the scheme adopted shall not interfere with shipping or future port development.

Pollution of a harbour is the natural result of a city around it, as all drainage gravitates towards sea level. Disposal of sewage by dilution in sea water is economical and effective, and many cities discharge their sewage to a harbour. As the city grows, the impurity load grows also, until it becomes offensive. Port authorities usually have legal powers to stop this, but in practice it is a long and laborious process to do so, as the cost of installing purification works or of disposing of the sewage elsewhere is a costly matter.

A city provides parks and sports grounds for athletic sports, and it is natural that a port should have facilities for aquatic sports. It has been customary to build swimming baths at suitable positions on the foreshore to take advantage of the plentiful supply of sea water. Modern standards of hygiene, however, require filtration plants for public baths, and with the introduction of these a large supply of sea water is unnecessary and baths can now be located elsewhere than on the foreshore.

Boat-harbours for pleasure craft are now a feature of most large ports, and these are becoming more and more in demand wherever boating is carried on. Growth of commercial shipping makes it necessary to concentrate pleasure craft in suitable places clear of shipping, and growth of population in the towns continually adds to the number of pleasure craft.

When a large enough area of suitable water is available, the boats can lie at moorings, swinging to wind and tide. Where the number is too great for this, it is customary to moor the boats fore and aft close together in small well-protected harbours. A large number can thus be accommodated in a comparatively small area.

Land is required to allow the boats to be hauled out in winter, and for clubhouses and buildings to house dinghies and gear, and also for the parking of cars.

Slipways, cleaning grids, landings, jetties for the supply of fuel and water are among the facilities that must be provided.

Some boat-harbours are provided and operated by private enterprise, many by the municipal authority in the same way as it provides parks and sports grounds, and others by the port authority.

The building, fitting-out and repair of yachts and launches is quite a big industry of considerable value to the trade of a town.

As a sport and as a recreation, yachting is also of great value to the community, the same as any other form of sport or recreation, and it is increasing in popularity wherever conditions allow it to be carried on. It is one form of recreation where one can leave behind the motor car, the telephone, the newspapers, the lawnmower, and other so-called amenities of a modern civilization and can set out with no fixed object in view.

To-morrow.

I have attempted to give a general picture of the port of to-day as compared with the port of yesterday. I have touched on so many subjects that a better title for my address might have been, in the words of Lewis Carroll, "Of shoes and ships and sealing-wax, of cabbages and kings". I have done so in order to show some of the problems, both engineering and commercial, that have been met, but even so, I have by no means mentioned all the changes that have occurred in this brief period.

What will the port of to-morrow be? We have already seen the flying boat come, have built bases in our harbours to suit it, and are now seeing it give way to the land plane. We do not know if, or when, or in what form, it may return.

A very big proportion of our passenger traffic is already handled by air services. It is not likely that the heavy cargoes now carried by sea will ever be carried by air, but it is by no means certain that so many will have to be carried. Science may well find a substitute for much of this, or our methods of trade, or even our way of living, may change.

The port and the ship of to-morrow may be very different from the port and the ship of to-day.

New Shipyard at Lowestoft

(Concluded from page 276)

The main design of the building is based on the strength of the columns to resist wind loading on the sides, and vertical loading, including eccentric effects arising from the cranes and floors, wherever the latter occur. On this method the deadweight of concrete is used to advantage. The foundations are designed to suit the overturning effects arising from the columns, and to limit bearing pressures to two tons per sq. ft., prestressed concrete piles being used where the ground is not capable of giving the required resistance.

The main columns which form the sides of the frames over the central shop weigh 16 tons each, and are suitably shaped to receive the prestressed concrete crane gantry bearer. The frame top is completed by prestressed concrete roof bearer beam 4-ft. deep at the centre reducing to 1-ft. 9-in. at the ends with a constant width of 20-in. These members are prestressed with 100 wires 0.2-in. dia. and have a weight of 15 tons each. The beam ends are located on the column tops by bolts and cast-in nuts.

A similar construction is used for the annexe roof, the inner sides of the roof bearers resting on brackets on the main columns.

The frames are connected longitudinally by purlins, eaves units, side members and valley gutters, all in prestressed concrete.

To meet windage effects, the lintel over the gable doors (50-ft. wide x 30-ft. high) is a hollow prestressed beam 34-in. x 21-in. section which spans between corner columns of the central shop. The beam weight of 15 tons is carried on the two columns which frame the door opening and the end connections to the corner columns are designed to allow for a slight subsidence of the gable columns.

Where first floors are required in the annexes they are carried on prestressed concrete bearer beams supported on brackets on the columns. Longitudinal secondary beams resting in shoes bolted to the bearers receive the timber decking which forms the actual floor, the whole arrangement being designed for a super-load of 40 lbs. per sq. ft.

The roof is covered with "Universal" asbestos cement reinforced troughing sheets with roof lights suitably spaced to augment the lighting from the "Perspex" glazing in the side walls. It is notable that the design of roof bearer beams suits the inclination required for the roof sheets. The roof is designed for a superload of 15 lbs. per sq. ft.

Side cladding is in asbestos cement sheets and perspex glazing to 9-ft. from ground level or to first floor where this occurs. Below this level, to avoid accident damage, walls are in prestressed concrete slabs 3-in. thick. In the main gables prestressed slabs are carried up to the door lintel.

The Humber Ports

(5) Engineering Works at Hull—1

(Specially Contributed)

(Continued from page 198)

WHEN the Docks and Inland Waterways Executive took over the management of the Humber Ports at Hull, Grimsby and Immingham at the beginning of 1949, they were faced with many problems of engineering, maintenance and reconstruction. Owing to economies in expenditure which had had to be imposed from 1930 onwards, coupled with shortage of labour and materials during the war years, there were substantial arrears of maintenance at all docks. Moreover, Hull in particular had suffered severely by enemy bombing, leaving a heavy burden of war damage repairs and reconstruction, in addition to improvements and developments necessary to expedite the turn-round of shipping and to bring the ports up to a standard of facilities and equipment capable of dealing expeditiously and economically with traffic under conditions which, in some respects, had shewn a considerable change since before the war. One particular aspect of such changing conditions was the emphasis placed on improved road access to the various berths.

It will be convenient to describe separately for the various ports the measures which have been taken over the last five years to overcome these arrears of maintenance and reconstruction and to effect improvements. Brief reference will then be made to the more important developments in prospect, of which some have already received provisional approval, and others are being brought forward in various stages so as to provide for a continuous programme of reconstruction and improvement at each port.

At Hull the London and North Eastern Railway had previously framed a programme of post war reconstruction, the first stages of which were already in hand, and the first essential under the new management was to expedite this programme to meet the immediate needs of the port.

Transit Sheds and Warehouses.

The most pressing need was for covered storage and transit accommodation owing to the very heavy loss of sheds and warehouses which had been sustained during the war, as out of a pre-war total of some 60 buildings of this character, only 33 remained after the effects of enemy action; the number of effective shed berths had in consequence been reduced from 56 to 25. The first steps were to construct a number of sheds at the more important berths, the ground space being substantially the same as that occupied by the former buildings, but the type of construction being restricted to single storey steel framed buildings so as to provide accommodation in the shortest possible time. The design generally adopted comprised a conventional trussed roof construction having 1 in 2 slopes with stanchions at about 12-ft. centres and giving a height of 15-ft. to eaves. The spans were fixed to suit the site and the cladding was normally corrugated sheeting of galvanised steel where liable to damage from traffic operations, and of asbestos cement elsewhere, with a continuous course of patent glazing in one slope of the roof. Internal sliding doors were provided in alternate bays, the clear openings being 11-ft. wide by 12-ft. 6-in. high. The floors were of concrete with granolithic surfacings. A typical section of this type of shed is shewn in Fig. 1. The first two sheds to be erected were Nos. 17 and 26 at the north-east corner of Albert Dock, of 49-ft. span and lengths 493 and 444-ft. respectively. Each shed was divided into two halves by a brick fire wall complying with the requirements of the Fire Officers' Committee.

The original warehouses had been of the multi-storey type served by hydraulic wall cranes, but it was decided to provide for the use of mobile cranes in the new sheds. The doorway clearances and floor levels were therefore designed to suit diesel electric mobile cranes of 5-ton capacity, and precautions were taken to protect the vulnerable portions of the structure on the dock side against accidental damage. Gutters and downpipes are of steel and a steel deflecting plate was fitted under the gutter so as to prevent crane hooks or loads from catching under the gutter and possibly tearing it away. Similarly a steel protection plate was fitted at the door lintels, backed by timber fillers bolted to the eaves beams. The first shed was finished in February, 1949, and the second in 1950.

In the Humber Dock three sheds of obsolete design, damaged by enemy action, were rebuilt, each new shed being 140-ft. long, somewhat less than 33-ft. wide, with a headway clearance to the eaves of 15-ft. In Victoria Dock, No. 1 Shed, destroyed by enemy action, was replaced by a new steel

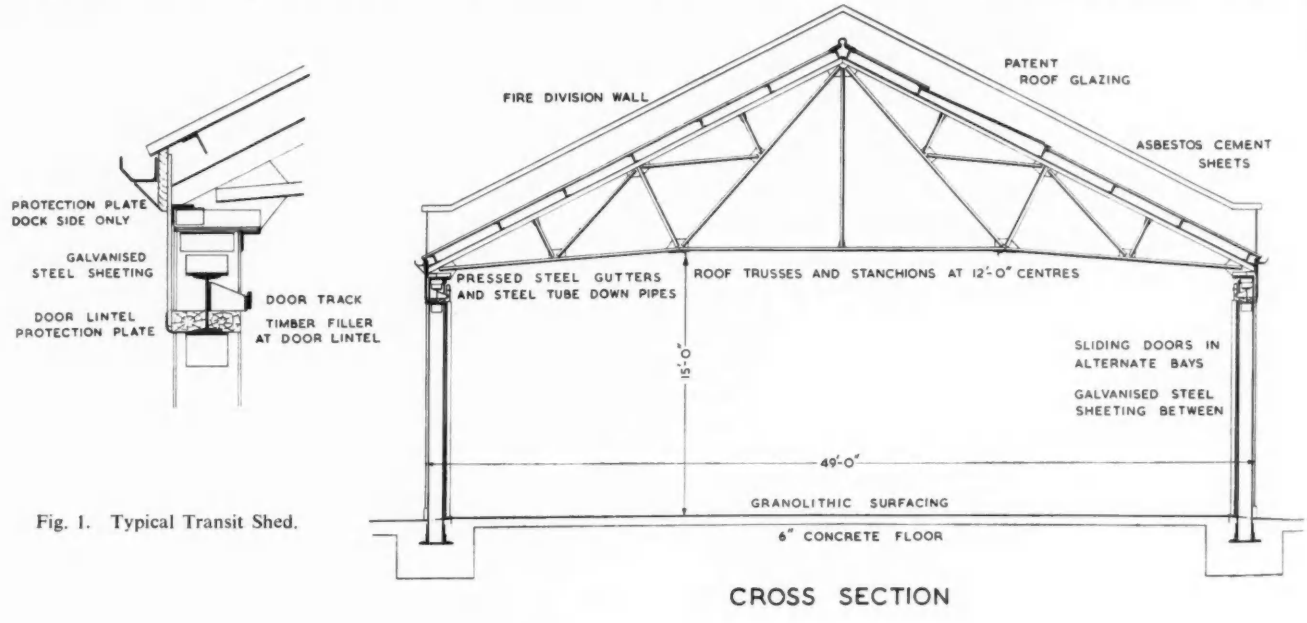


Fig. 1. Typical Transit Shed.

The Humber Ports—continued

framed shed 234-ft. by 65-ft. wide by 14-ft. to eaves, with a new deck in reinforced concrete supported by steel joists carried by the existing timber piling.

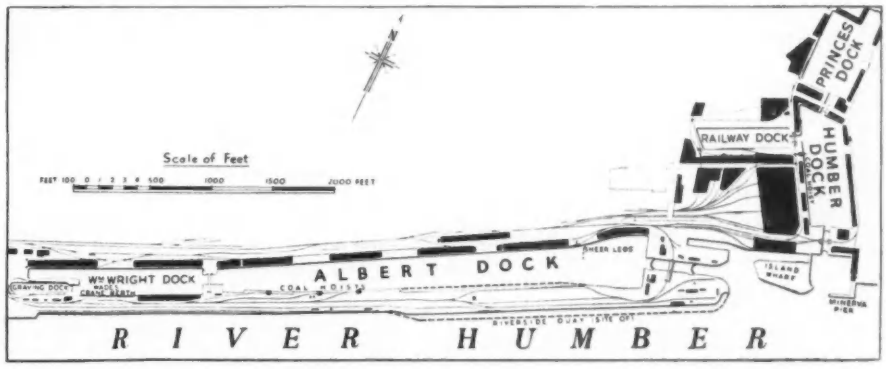
Similarly four more single storey steel transit sheds have been provided at the Alexandra Dock.

The total cost of providing the steel single storey transit sheds mentioned above with associated works was approximately £150,000.

Mention may be made here of the replacement of No. 1 Shed, Humber Dock, totally destroyed by fire in July, 1951. The original shed was of timber framed and boarded construction supported by cast iron columns, and was some 580-ft. long, 34-ft. wide, and 10-ft. 6-in. high to eaves. It was intensively used in connection with the near Continental trade and its loss was keenly felt by local interests, particularly in the fruit trade.

Accordingly a scheme was developed for adapting the standard precast concrete buildings sponsored by the Ministry of Agriculture and Fisheries for farm purposes, components for which were readily available from stocks held locally. The type selected comprised concrete posts, beams and purlins, with light steel roof trusses of 33-ft. span, 12-ft. high to eaves, at 15-ft. centres over a total length of 585-ft., the nearest possible approximation to the original dimensions. Alternate bays were filled with solid brick panel walls, the intervening bays being provided with steel framed and sheeted sliding doors. Precast reinforced concrete purlins supported asbestos cement roof sheeting with perspex sheet lights at intervals, and aluminium gutters and downpipes were used throughout. The original wood-block flooring was renovated wherever possible, but some portions which had suffered from the effects of the fire and subsequent exposure to the weather were replaced in concrete. Orders for the building components were placed at the end of April, 1952, and erection of the building commenced in June, the whole shed being available for occupation by November.

The most pressing needs for replacement of shed accommodation destroyed or damaged by enemy action having thus been met, consideration was then given to the



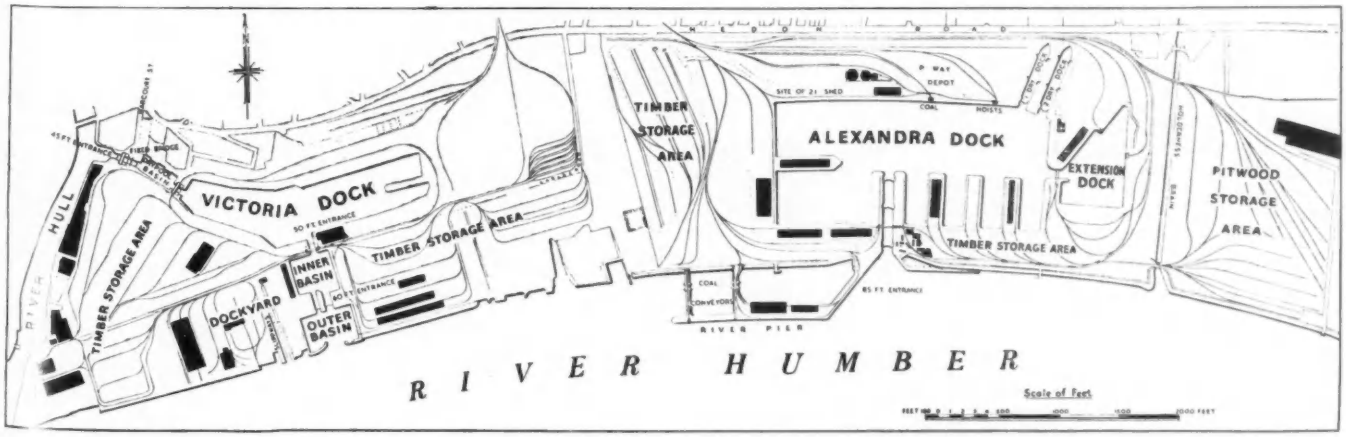
improvement of certain other sheds where the effects of arrears of maintenance were causing difficulty and inconvenience in working, or where modernisation was called for. This work comprised relaying shed floors in concrete paving with granolithic surface, and quay surfaces in concrete; relaying railway tracks, together with recovering the roofs and sides of sheds with corrugated asbestos and steel sheeting.

Roadways.

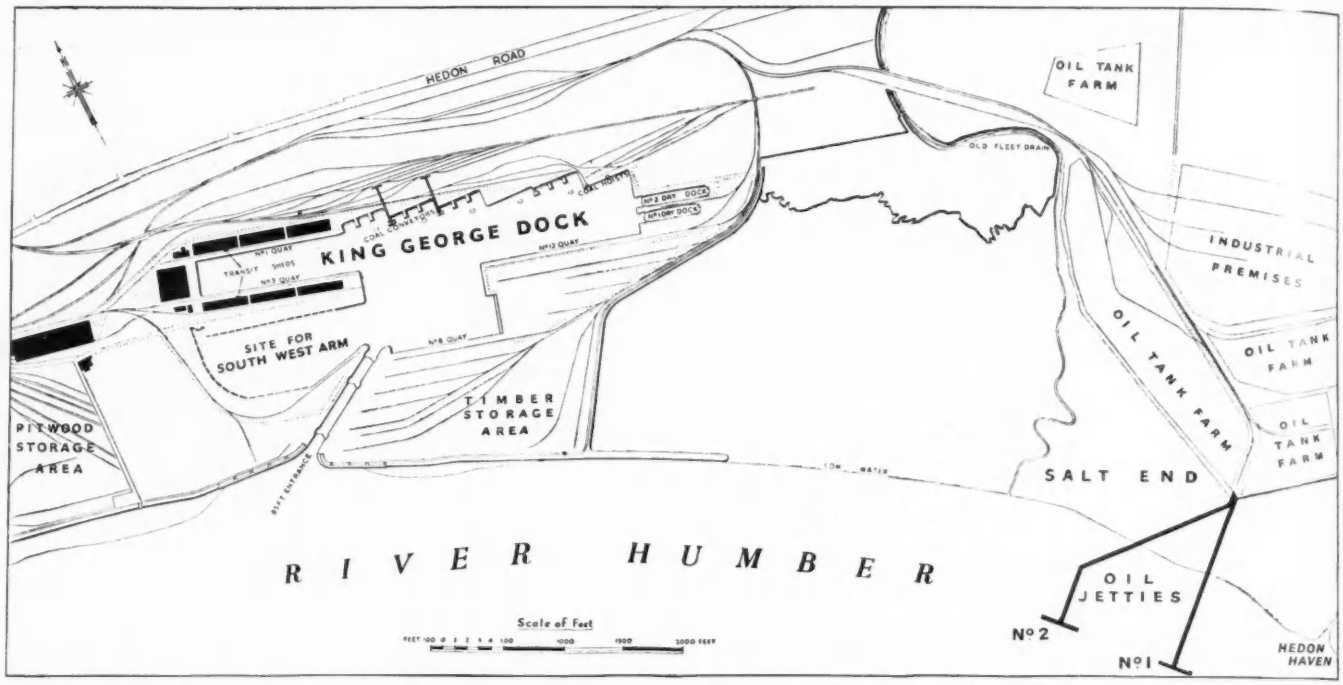
In addition to and concurrently with the shed reconstruction and improvement, a number of projects for improved road access were authorised. The most important comprised the reconstruction and widening of the main road on the north side of Nos. 1, 2 and 3 Sheds, King George Dock. Generally speaking, the roads at this dock remain substantially in the form of their original construction in 1912, comprising mainly sett-paved surfacing on a chalk formation. Immediately to the north of the sheds were two lines of railway track in sett paving, beyond which the clear width of the road did not exceed 18-ft. This narrow width, with consequent congestion from both through and local traffic serving the sheds, combined with the way in which the road was beginning to break up under increasingly heavy vehicles, brought about the necessity for its reconstruction in reinforced concrete with a rolled asphalt wearing surface to a width of 30-ft. beyond the rail tracks. This widening necessitated substantial modification of the railway sidings to the north coupled with renewal and repairing of the wagon tracks behind the sheds. Subsequent road improvements included the widening to 30-ft. of the whole of the South Roadway at Alexandra Dock west of the lock entrance.

At Victoria Dock an important area of the Dock Estate forms an island site separated from the mainland by two lock entrances and accessible only over cast iron swing bridges upwards of 100 years old. The bridge over the main 50-ft. entrance carries a double line of rails, in addition to catering for road traffic, and had been partially reconstructed and strengthened in 1928. At the Drypool entrance, however, only one of the two swing bridges carries a line of rails, and both bridges were inadequate for modern road traffic. The greatest need for heavy road vehicles to the island portion of the Estate was from the Drypool side, but on a comprehensive view reconstruction of the 50-ft. entrance bridge was more justifiable. It was, therefore, decided as a temporary measure to provide a fixed road bridge over the Drypool entrance, capable of carrying the heaviest types of road vehicle likely to be encountered, in such a way that although the entrance would thereby cease to be available for shipping, barge and lighter traffic could still be accommodated under certain conditions.

Investigation shewed that a pre-stressed concrete bridge offered several advantages, not the least being a minimum of interference with existing works and the readiness with which it could be dismantled and removed at any time in the future. The design



The Humber Ports—continued



adopted allowed for a single line of traffic and comprised eight 52-ft. monolithic beams precast on an adjacent site, partially post-tensioned (on the Lee McCall system) before erection and finally post-tensioned after erection. The beams were also tied together by lateral rods similarly post-tensioned after erection. Kerbs and hand rails were provided, together with a wearing coat of tarmacadam. This bridge, of which details are shown in Fig. 2, was constructed in the short space of four months between May and September, 1952, at a cost of £1,820.

Authority was then given for the opening up of road access between Earles Road on the east side of Victoria Dock and the 50-ft. Entrance Bridge, at an estimated cost of £4,800. This was largely a straightforward matter comprising tarmac road surfacing on consolidated hardcore foundations, but involved a large amount of permanent way work in slewing and relaying sidings with a complicated series of junctions, so as to permit of adequate clearances for road traffic.

Quays.

The provision of additional shed accommodation and improved road access having thus received attention, another important category of works requiring consideration was that of repaving quay surfaces and reconstructing quay structures, in order to deal with arrears of maintenance or to provide for additional cranage and other facilities.

A major scheme was the modernisation of Wade's Crane Berth, on the south side of William Wright Dock. This berth is alongside a solid brick and masonry quay wall some 450-ft. long, and was originally equipped with two 3-ton and two 1¼-ton hydraulic cranes of 30-ft. radius. The quay was served by three lines of rails, but was unpaved and had no facilities for moving wagons. It was decided in 1950 to replace the obsolete cranes by four new electric travelling cranes of 3 tons capacity at 65-ft. radius. This involved the provision of new crane tracks, 15 feet from centre to centre, which were to be made capable of carrying cranes of 10 tons capacity in anticipation of further developments in the future. Owing to the poor ground—alluvial deposits to a depth of 30-50 feet are the general rule throughout the Hull Dock Estate—piling was necessary for the rear track, and the main beam was accordingly supported on 15-in. x 15-in. precast concrete piles 50-ft. long placed in pairs at 25-ft. centres. The quay wall afforded adequate support for the front track. Each track was built up from twin bull head rails, the cranes being provided with centre-flange wheels in accordance with standard practice recently adopted throughout the Humber Ports for all new works. The permanent way was modified to make room for electric capstans to be installed, and also to provide the greater clearances required by modern standards, advantage being taken of the increased radius of the new cranes in this connection. Concrete paving flush with the railheads was then laid on the quay surface from the coping up to the second wagon track, with connection to existing road access at the east end of the quay. The work was carried out in August, 1951, and cost £25,100.

The most important work in this category, and the largest single development undertaken within the Humber Ports during the period under review, was the reconstruction of No. 12 Quay, King George Dock, Hull. The former quay, dating from the original construction of the dock in 1914, comprised a timber piled structure some 1,320 feet in length, built over a stone-pitched slope, and was provided with two wagon tracks and timber decking carried on rolled steel channel half-crown beams. Electric cranes of 3 tons capacity were carried on a pair of single rails at 15-ft. centres, each rail being directly supported by rolled steel joists spanning between the crown beams. Over a period of 35 years, this structure had given good service, but gradual deterioration of the decking system had become apparent and since the war a large number of the steel joists carrying the crane tracks had had to be replaced. Consideration was given to a straightforward renewal of the deck, as the main piles of Blue Gum were still in excel-

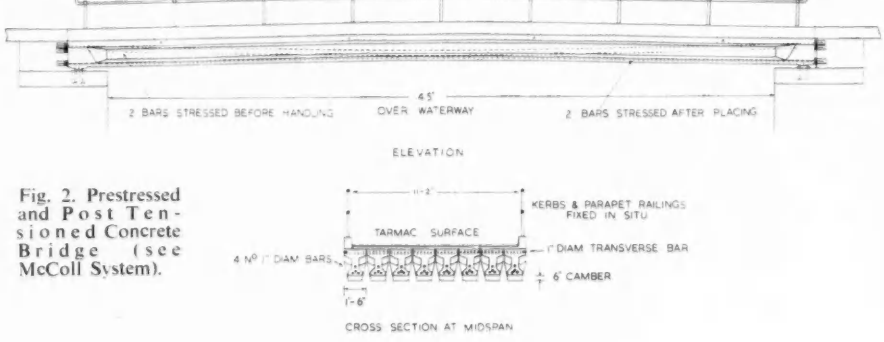


Fig. 2. Prestressed and Post Tensioned Concrete Bridge (see McColl System).

The Humber Ports—continued

t condition. In view, however, of the fact t the structure as a whole was inadequate cater for locomotives or the higher pacity cranes desirable to meet modern erating requirements, it was decided to dertake complete reconstruction. Rein- ced concrete was chosen on grounds of rability and economy in maintenance, and design of the conventional piled and ced type with a beam and slab deck was epared.

The problem of designing fenders to give tisfactory protection from the impact of ssels often gives rise to difficulty in struc- es of this kind, but was solved in this stance by retaining and adapting the major rt of the original timber piled structure, low deck level, so as to form a complete ndering system independent of the new ncrete quay work. New walings, rubbing mbers and copings were allowed for as cessary. The reinforced concrete load aring deck was designed to carry new ane tracks of standard twin flat bottom rail sign, and two lines of standard gauge rail- ay for wagons and locomotives. These agon tracks were fully checked throughout, e rails being supported directly by the deck ithout sleepers or chairs. The whole of e deck was covered with concrete 7-in. ick up to the level of the rail heads to rm a flush quay surface suitable for road hicles; this concrete also served the rpose of giving proper lateral support to e crane and wagon tracks and of providing ver for service ducts. Full provision for ane plug boxes, electric capstans, fresh ater and fire services was made, and in ddition to revising the layout of the rail acks on and behind the quay, completely w access lines were planned to serve the ay with direct connections to the running es at the east end of the dock.

Following preliminary departmental work n railway approach lines and connections, contract was placed in April, 1952, with e Yorkshire Hennebique Contracting Co., td., for the demolition of the timber deck, daptation of the timber substructure, and e construction of the reinforced concrete ay structure.

In the full length of the quay there are 1 bents at 15-ft. centres, each comprising even 16-in. x 16-in. reinforced concrete pre- ast piles driven through or behind the xisting stone pitched slope. Five piles in ach bent are vertical, one pair 55-ft. long eing on the front of the quay, a second pair 0-ft. long on the centre line, and a single ile 50-ft. long completing the number irectly supporting the quay proper. The emaining two piles are driven at a 1 in 4 pposing rake some 18-ft. behind the quay o act as anchorages. The pairs of piles at he front and in the middle of the quay are ocated so as to give direct support to the ront and rear crane beams respectively. The driving of the piles was straightforward nd little difficulty was experienced in ecuring the designed alignment and penetration, the low level in situ work of concreting the pile caps, etc., could be carried out, however, only when the water in the dock could be kept down to a low level, and this was possible only over periods of neap tides.

One of the new 3/6 ton level luffing portal electric cranes at King George Dock.

To simplify his work the contractor elected to precast most of the horizontal and diagonal bracing members, and by careful planning of the various operations their placing and concreting in position at these periods was sufficiently rapid to enable good average progress to be maintained. The upper work comprising longitudinal and transverse deck beams, deck slab and deck topping concrete was all cast in situ and was arranged to follow up closely behind the tidal work. By this means the work made steady progress from the east to the west end of the quay, and as each length (normally 80-ft. the distance between consecutive bollards) was completed, it was handed over immediately for traffic use. The total length of quay occupied by the contractor at any one time was carefully regulated and he was not allowed to encroach on the last berth westwards until a complete berth was available at the east end of the quay; in this way a minimum of one berth on the quay was always in commission and for most of the time two berths were available. In order to maintain an effective rail service to the berths on the old quay while normal access was severed by the contractor's operations to the east, temporary rail connections were laid in as required from a loop line specially provided at the rear of the working area.

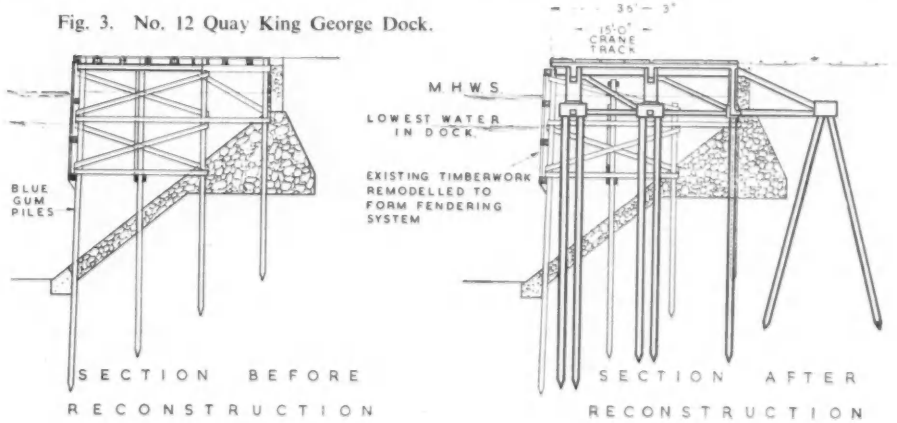
Detail of the work involved is shown in Fig. 3. It was successfully completed within the contract period of 21 months and the whole of the quay was handed over for traffic in April, 1954. The total cost was £210,000.

Mechanical and Electrical Re-Equipment of King George Dock.

In order to provide the most up-to-date equipment and so facilitate the quickest possible turn-round of shipping, new cranes are being supplied at the King George Dock, and the electrical distribution system converted from direct to alternating current. Forty-five high speed cranes are on order, described in greater detail below, and a start has been made with the electrical alterations, which involve considerable substitution of plant. The recraning scheme and associated work—nearly a £1 million job—will be completed within the next two to three years, being largely governed by the delivery dates of the cranes.

It was decided to abandon the existing direct current supply point and provide a main incoming A.C. substation adjacent to the Grain Silo. This scheme has the advantage that the whole of the A.C. system can be completely installed before the direct current service is ceased thus causing no restriction in dock working. The main electricity service is to be taken from the Yorkshire Electricity Board's substation adjacent to the King George Dock area at a voltage of 6,600 volts 3 phase 50 cycles using 0.3 sq. in. 3 core P.I.L.C.S.T.A. & S. cables to the Board's substation "A" adjacent to the Grain Silo. From this substation and generally in accordance with the schematic diagram (Fig. 4) a ring feeder serving substations "B," "C" and "D" is in-

Fig. 3. No. 12 Quay King George Dock.



The Humber Ports—continued

stalled. The low voltage distribution is given from each substation, each area of distribution being separate. This service, at 415/230 volts, is afforded by oil insulated naturally cooled static transformers, delta connected on the high voltage and star connected on the low voltage side, the star point being solidly earthed and utilised for the provision of lighting services.

The substation transformer capacity is as shown on the diagram (Fig. 4) and for standardisation purposes and in order to give flexibility in operation the transformers have been restricted in size to 1,000 KVA and 500 KVA. In accordance with the modern trend regarding low voltage switchgear air break switchgear having a rupturing capacity of 25 MVA at 415 volts is used exclusively except for distributors having a capacity of 300 amperes or less where quick break air break switches in conjunction with high rupturing capacity fuses are utilised. The whole of the switchgear is of the cubicle type provided with flush instruments, the high voltage gear being of the vertical isolation type and the low voltage gear having horizontal draw out isolation.

Local low voltage distribution to cranes and capstans is afforded by distribution pillars installed in close proximity to the plant to be served, e.g. at the end or middle of a quay. For large demands such as a battery of cranes air break circuit breakers provided with "close" and "open" push buttons fitted with load discriminating relays are utilised whilst for small demands air break switches in conjunction with H.R.C. fuses are used.

The new cranes are designed for a lifting speed of 150-ft. per minute with a load of 6-tons on the hook and 300-ft. per minute

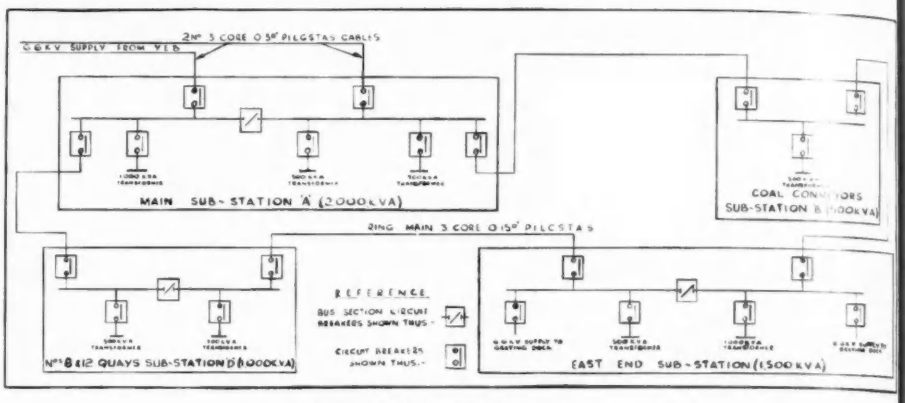

2 No. 3 CORE 0.15" PILCSTAS CABLES
6.6 K.V. SUPPLY FROM W.E.B.
MAIN SUB-STATION 'A' (2000 K.V.A)
COAL CONVEYORS SUB-STATION B (1000 K.V.A)
RING MAIN 3 CORE 0.15" PILCSTAS
REFERENCE
BUS SECTION CIRCUIT BREAKERS SHOWN THUS:-
CIRCUIT BREAKERS SHOWN THUS:-
No. 8 & 12 QUAYS SUB-STATION B (1000 K.V.A)
EAST END SUB-STATION (1500 K.V.A)

Fig. 4. Sub-station Transformer capacities.

with a load of 3-tons on the hook, the wheel gauge being 15-ft., minimum radius 20-ft. and the maximum radius 70-ft. The slewing speed with full load at maximum radius is 500-ft. per minute and the full load luffing speed is 120-ft. per minute. The cranes are of the fully portal type allowing one line of rail traffic to pass under and they are capable of travelling at 50-ft. per minute along the crane rail track. In order that the cranes may deal with bulk materials Priestman grabs and the necessary adjustable discharge gear are provided.

Electrical energy is supplied to each crane at 415 volts 3 phase 50 cycles, the supply being given through a 4 core tough rubber sheathed flexible cable terminating in a plug inserted into an interlocking switched socket, this being fully waterproof and installed at ground level.

The hydraulic pressure service to the Coal Hoists and Lockgates is afforded by four high pressure pumps having a capacity of 250 gallons per minute each at a pressure of 850 pounds per square inch, each pump having the existing motor substituted by a 200 horse power 3 phase 415 volt 50 cycle induction motor together with the associated automatic control gear.

The Grain Silo is operated by 54 conveyors and 20 elevators requiring some 80 electric motors for these and other services. The equipment for unloading grain from vessels at present comprises 6 elevators each of 120 tons per hour capacity attached to cranes, six 60 tons per hour and two 100 tons per hour portable elevators and one 60 tons per hour rail borne suction plant. All the motors are being replaced by 415 volts 3 phase induction motors controlled by manually operated starters having sequence control and electrical interlocks between the various elevator and conveyor units. At the same time the opportunity is being taken to substitute gearing of modern design for the existing conveyor and elevator mechanical drives.

The Graving Dock pumping plant at King George Dock comprises two main centrifugal pumps capable of pumping 36,000 gallons of water per minute against a maximum head of 40-ft. Each pump is direct coupled to a 450 horse power induction motor designed for operation on a 3 phase 50 cycle 6,600 volt system being manually controlled by means of contactor type starting equipment. The smaller 75 horse power drainage pump and other auxiliaries are to be driven by 415 volts 3 phase 50 cycle motors with associated automatic starting equipment.

Capstans are installed on various parts of the dock for the purposes of wagon movement and these are being completely redesigned, each capstan being fitted with a squirrel cage induction motor driving the capstan head through a centrifugal clutch and worm gear and controlled by a direct on line contactor starter operated from a foot pedal. The particular feature of this conversion is the use of a load discriminating overload device which, whilst allowing the necessary high starting current, restricts the load under normal working conditions to one and a quarter times full load.

(To be continued)

Work in progress on reconstruction of No. 12 Quay King George Dock, Hull.

Cargo Handling on Board Ship

The Problem of Heavy Lifts

Addressing a meeting of the Honourable Company of Master Mariners which was held in London last month on board H.Q.S. "Wellington," Captain J. D. F. Elvish (marine superintendent, The Clan Line Steamers Ltd.) described the gear on board one of his company's all-purpose vessels and explained some of the problems of lifting heavy cargoes.

Captain Elvish said the ships of his company had a great variety of items of cargo to cover and an all-purpose vessel had been developed. She was well-equipped with the usual 5-ton derricks and winches; the derricks turned through as large an arc as possible, in some cases as much as 180 deg., to enable them to serve two holds. The winches were of sufficient power to serve the heavy derricks as well; of these there was usually one of 80 tons and one or more of 30-40 tons, although some of the company's ships were equipped with derricks having lifting capacities of 105 or 125 tons. The larger derricks were served by special winches in the 'tween decks, but all the others by combining the service of two winches by a centre barrel. The aim was to be able to handle rolling stock and any heavy cargo, and to that end, the vessels were fitted with a very large main hatch, up to 50-ft. in length, and plenty of clear deck space for deck loads.

To handle the heavy items in the hold, an elaborate system of eyeplates was fitted, both to take in the heaving-in gear and also as securing points when the lift was in place. Those points were fitted on bulkheads, the shell plating and on the overhead deck, all places being specially stiffened to take the load. The overhead eyeplates were particularly necessary as stevedores were very prone to use beam grabs with disastrous results to the beams and the possible weakening of the deck above. Ships built to carry such cargoes needed a good amount of initial stability to keep the heel in ballast trim reasonable when a lift was suspended outboard, and also to allow for fairly substantial deck loads. Holds loaded with locomotives were not very much help to stability when their deadweight was considered in relation to space occupied. It was also necessary to avoid slack oil or ballast tanks when handling lifts. Experience had taught the company to guy the lift and not the derrick. Steam guys were used and a derrick head guy could exert a very heavy compression load on a derrick when in the hands of a careless winchman.

The Ideal Hold

One of the biggest problems of quick and efficient stowage was the method of handling the various commodities once they arrived in the hold. If the hold had a considerable run back to the bulkhead, time and energy could be wasted in man-handling or heaving cargo in to fill that space. The ideal hold was one where any run in was equally divided between the two ends of the hold. Even with a 50-ft. hatchway and a hold of 90-ft. in length, the least that could be hoped for was about 20-ft. at each end. Very heavy cargo presented little difficulty as it was handled by heaving in tackles and skids. The lighter items had to be dealt with by hand trucks or man-handled. In that respect, attempts to introduce mechanical trucks or other means had met with considerable resistance on the part of labour, who appeared to regard them as a threat to the size of the gangs.

Referring to bulk cargoes, Captain Elvish said that although bulk oil was the most publicised cargo, most cargo liners carried vegetable oil and liquid rubber. In the range of dry bulk cargoes, sugar was a newcomer and the usual ships in the bulk sugar trade were tramps, mostly fitted with deep tanks for ballast runs. Those deep tanks were not helpful for quick discharge by grabs and were obviously very susceptible to damage. Some ships were now in operation, however, where that type of tank had been dispensed with.

The handling of deep-freeze cargoes was relatively simple but their stowage was not so easy. Associated with such cargoes were problems of taint, which could occur between different items of the same cargo, or between different cargoes, when it had to be removed between discharge and loading. Taint was of course a problem in other dry cargoes comprising a wide range of commodities, where proper stowage was very necessary in order to avoid claims. As a simple example, tea and pepper did not mix well. Many dry cargoes needed special care, both in stowage and handling; a good example was newsprint, where a small hook-hole did a tremendous amount of damage.

On the question of shore-based gear, Captain Elvish said that from the ships' point of view by far the most useful was the floating crane, and London and Liverpool were exceedingly well-equipped in that direction. Cranes were also another form of shipboard gear and were popular in Scandinavian vessels and in many British short-sea traders, being very handy for lighter loads. After considerable experience in all sorts of trades, he had come to the conclusion that for the very mixed general cargoes which the cargo liner handled the derrick rig was the best. It might be old-fashioned, it might look crude, but it worked well under all conditions and was remarkably adaptable. One factor in that connection which was not fully appreciated was that ships' gear "married" or Liverpool rigged (i.e. one derrick over the hold and the other over the shore or lighter, and their two falls linked together) gave faster working and higher tonnages than the shore cranes.

Some Thoughts on Ports

Differences in Port Working Methods

In this article (slightly abridged), which appeared in a recent issue of the "East African Railways and Harbours Journal," the new Commissioner for Transport, Major-General W. D. A. Williams, C.B., C.B.E., gives his first impressions of East African ports and also compares war-time and post-war methods of port working.

Of all the innumerable branches of the art and science of transportation, I have always personally thought that the most fascinating was that of ports and port operation. This arises from three main reasons: firstly, that the port is the link with the outside world and still retains much of the glamour of new contacts and of merchant adventure, and secondly, that a port although not in itself a carrier, is the junction between several transportation media—the ship, the railway, roads or inland or coastal shipping. The port operator is, therefore, always in contact with and has to consider the requirements of many organisations with divergent interests and methods. He can never get into a fixed routine but must always be flexible in his approach to all the day-to-day problems which arise.

The third, and in some ways the principal, attraction of ports, is the fact that the more that you see in the world the more you realise that no two are ever the same. Their differences stem from many causes—the history of their growth, their geographical situation, the type of traffic for which they cater, and the diversity of the human beings who operate them. The ports of East Africa have their own diversities in common with all other ports in the world.

The difference in working method caused by difference in traffic requirements tempts me to draw a striking comparison between what might be called the easiest method of cargo-working and one of the most difficult.

Vagaries of enemy interference apart, the simplest is perhaps the handling of military cargoes in war-time, and in brief the system, as developed during the years 1939-45 in the United Kingdom, was as follows:—

(a) Before a ship ever came on the berth, the whole of its cargo was pre-planned in detail on a graphical stowage plan.
(b) Based on this, every consignment was called forward in such a way as to arrive at the port of loading as and when required for its stage in the overall process of loading.
(c) Depots of origin were comparatively few in number and almost the whole of the traffic moved either by special train or by fast scheduled services. On arrival everything was loaded direct from wagon to ship. Practically no cargo ever went into a shed, and the only essentials to expeditious working were a wide-open quay, a sufficiency of quay-side tracks, and good shunting.

At the receiving end, matters were even simpler. Delivery was again made direct to road or rail vehicle; the consignees were few, being merely the principal service depots and they were normally

Some Thoughts on Ports—continued

within a few miles' radius of the port. The total marks did not exceed some dozen simple coloured patterns for the principal services, and documentation was reduced to an absolute minimum. Tallying was in effect primarily for the purpose of identification and as a moral deterrent to pilferage; meticulous counting of individual packages was neither necessary nor expected.

At the opposite end of the scale we might consider conditions as they exist to-day in the Port of Mombasa, where conditions are entirely reversed. The numbers of consignees are legion; every one of their packages must be tallied with meticulous accuracy, every single article of every consignment must go either to shed or to stack and be sorted to an individual number, and in fact quite apart from the ordinary business of handling cargo the port is in effect bound to act almost as a wholesale distributing warehouse.

The whole process inevitably entails many handlings of every package and it is impossible to expect that cargo can be handled at the same rate as under the conditions which attend similar processes in war. It is clear that to carry on this work requires a shed area far in excess of that normally found in comparable installations elsewhere in the world, and although new transit sheds are now being built, yet it will be some time before the actual operators have elbow-room in which to move freely.

On top of this the port is handicapped by the fact that while it is continuing to work, its whole layout has been pulled to pieces in the processes of reconstruction and, added to its own traffic, are the movements of all the constructional vehicles engaged in this great engineering task. Nevertheless, in spite of all these difficulties, the through-put of the port is in fact increasing and I felt confident with the rapid approach to completion of three magnificent new sheds and the stub-head lighter jetties, that the worst troubles of the port were over, and that an ever-increasing improvement was on the threshold of attainment.

No Uniformity in Cargo-Handling

Another matter I found of great interest was the actual method by which the stevedoring, the documentation and the physical movement of goods through the port were effected. There is, of course, no uniformity on these subjects throughout the ports of the world and wherever one goes there are always several authorities involved in the various processes of getting stuff out of the ship's hold and finally on to vehicle for delivery to consignee. I have always myself tried to inculcate two principles: firstly, that there must be one man, and one man only, in charge; and, secondly, that so long as this principle is observed, there was little point in laying down meticulous subdivisions of responsibility between any one individual and another. I have always tried to teach that it did not, within limits, matter so much who exactly did what, so long as everyone was imbued with the one spirit of service to the port, and so working towards that common end.

Dar es Salaam and Tanga, though in many ways very different from Mombasa, are at least alike in that for the present they are both lighterage ports. Lighterage is a most interesting branch of port operation, although there is a tendency to look upon it in some ways as a "poor relation." It can in fact produce quite amazing figures of performance. To go back for a moment to war-time operation, lighterage is, of course, the very mainstay of any overseas assault operation, and indeed whenever a major port is completely destroyed or otherwise denied, it is only by lighterage-working from anchorages to minor ports or even beaches that armies can be maintained. The enormous tonnages which were landed in support of the British and American armies in Normandy are ample proof of the inherent value of this form of operation. But war-time working is, of course, only one aspect and even in peace-time such great world ports as London, Antwerp and Rotterdam, handle a very large proportion of their cargoes "overside."

Neither Dar es Salaam nor Tanga is in any operating difficulty at the moment, and both have very fine development projects in hand. Dar es Salaam with its deep-water berths next year, will add the advantages of alongside operation to its present facilities and should possess ample capacity for some time to come. Similarly, the capacity of Tanga should be nearly double, and one is tempted to hope that it may become an attractive form of outlet for export crops down the Tanga Line, which naturally and economically ought not to take the more tortuous route to Mombasa.

Damage to Corrosion Test Station

Specimens Destroyed by Hurricane

Equipped with mine detectors, United States Marines are assisting in the search for thousands of valuable specimens on the Atlantic Coast at Kure Beach, North Carolina. The specimens were torn by a recent hurricane from racks 80-ft. from the ocean and buried deep in the sand by wind and waves that reduced the area to a shambles.

The racks formed part of the International Nickel Company's Corrosion Testing Station, established in 1935 and recognised today as the most extensive research project of its kind in the world. The station is equipped with facilities for studies on the behaviour of materials in sea air at Kure Beach, and in salt water at nearby Harbor Island. Activities at this station have yielded information on how bare and coated metals, woods, plastics and cordage are able to resist the corrosive effects of salt water, salt spray and sea air. These experiments have resulted in a saving to industry of many millions of pounds.

The destructive effects of the waves at Kure Beach were augmented by the battering action of floating timbers and piling from fishing piers smashed by the storm. The rack supports with their concrete anchors were wrenched out of the ground, and the pipe frames were bent and twisted completely out of shape. Waves piled sand up to a depth of about 3-ft. over that portion of the test site area that was not washed away.

It is believed that some of the specimens will be recovered, those near the surface by ordinary means, and those buried deeper by the use of mine detectors. The importance of salvaging the specimens, many of which have been under test for 15 years or longer, lies in the information disclosed by these test pieces during their many years of exposure to the natural environments in which materials must perform, and for which service the most durable must be selected. Although the tests have been violently disturbed, and many will have to be terminated prematurely, much still can be learned by studying what is left.

A larger test lot at Kure Beach, about 800-ft. from the ocean and in which nearly 30,000 specimens are exposed to atmospheric attack, was far enough back to escape damage by water. Despite the high winds, not more than a dozen test pieces fell out of the racks and these were quickly recovered and put back into test.

The laboratory at Harbor Island also suffered the ravages of the wind and a 12½-ft. tide which flooded the buildings to a depth of about 3-ft., resulting in considerable damage to motors and other apparatus. Floating debris damaged a dock which supported submerged test racks and several kinds of special testing equipment such as model heat exchangers. A large steel pontoon float which had been moored at the dock was picked up by the waves and wind and deposited on top of the dock structure. Although the laboratory office was flooded, there was however, time to move the records to safety.

It is estimated that the disaster will mark only a temporary interruption in the working programme, and it is planned to enlarge the razed site at Kure Beach when it is rebuilt. New racks will be set up and new specimens will be put into test along with those of the old ones that are found to be fit for further testing.

Boy Scouts' International Bureau

We have been asked to insert the following:—

"The Boy Scout Movement began in 1907 and has since spread throughout the five continents of the world. Among readers in the 85 countries in which "The Dock and Harbour Authority" circulates, there must be many who at some time or other have been associated with the Boy Scouts. They may possibly be unaware that there is in London "The Boy Scouts' International Bureau" which serves as the office of the International Conference and Committee, and maintains contact with member countries. The Director, Major-General Spry, G.B.E., D.S.O., C.D., at 132, Ebury Street, London, S.W.1, will be pleased to forward a brochure setting forth in detail the work of the Bureau to any dock and harbour executive who may be interested."

Manufacturers' Announcements

Sound Equipment at Port of Singapore

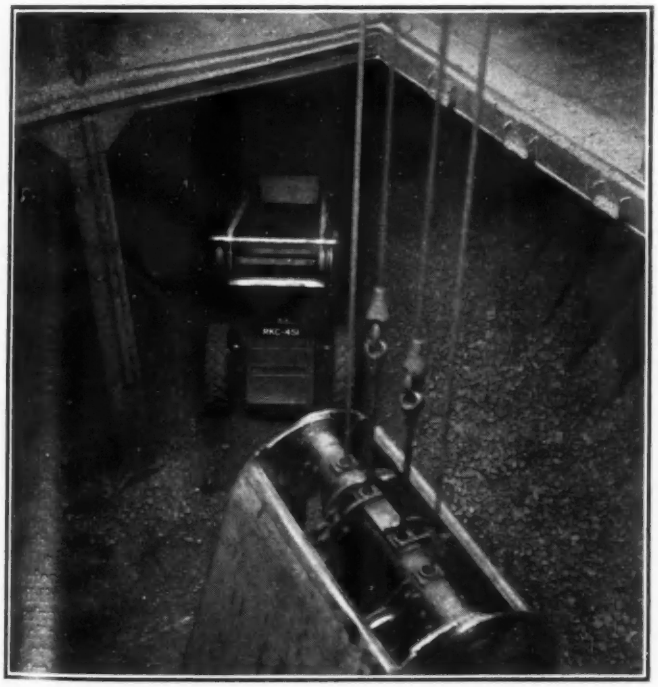
The King's Dock at Singapore, the largest dry dock in the state, has recently been equipped with a comprehensive public address system which carries instructions direct to any part of the dock; messages can even be given to a ship's crew when the vessel is still quarter of a mile outside the dock. Control is therefore much simplified, operations such as loading and unloading can be better organised, and a considerable saving is achieved in time and labour.

The equipment, which was supplied by The General Electric Co., Ltd., comprises six G.E.C. horn loudspeakers which are mounted on brackets attached to the dock lighting pylons. These brackets permit the loudspeakers to be turned through an angle of approximately 60°, ensuring a maximum efficiency.

Two microphones are provided and each of these can be plugged into any one of six loudspeakers installed along the dock side. The microphones employ a 4-core cable, the "press to talk" button being wired to the remote control switching system. Two microphone wiring networks are provided, one being a normal circuit while the other is a priority circuit enabling the foreman docker to cut in at any time for the purpose of giving urgent orders. The microphones are connected to the amplifiers by overhead wires, the loudspeakers by screened underground cable. The equipment includes two 30 watt amplifiers which, with a monitor loudspeaker and the associated control apparatus, are mounted on a rack.

Ship Trimming of Iron Ore

Iron ore from all over the world is discharged at Bidston Dock, Birkenhead, by Rea Ltd. The accompanying photograph shows one of Rea's Merton Overloaders helping to discharge a cargo of 8,700 tons of Swedish ore from the 5,415-ton ship s.s. Sarek.



A Merton Overloader is lowered into the ship when the grab has cleared sufficient space for it to work without interfering with the actual discharging operation. The machine then moves the ore from the sides of the hold under the wings and discharges it in the centre of the hold. It is claimed that this method can move about 100 tons of heavy ore per hour and enables stevedores to turn round ships more speedily than when trimming is done manually. To lift the machine on board it is not necessary to remove the grab, and the whole operation of lifting it in or out of the hold takes less than ten minutes. The bucket of the Overloader is operated by means of winches and ropes. The winches are mounted above the rear wheels on either side of the driver's cab, and are controlled by one lever which operates both the winch drive clutch and the winch brakes. The drive to the winches is taken from the front of the engine and is therefore completely independent of the master clutch. The Overloader is driven into the stockpile with the bucket lowered; the bucket is then brought up with a crowding action and travels up the two overhead rails; it is then discharged over the rear of the machine and a pair of springs—previously compressed by the bucket on its upward travel—return the bucket to the top of the rails, when it travels back to the digging position for the next cycle. The Overloader does not turn or slew, it shuttles backwards and forwards in a straight line. The speed of working is extremely fast—the complete cycle from loading the bucket to discharging and back to loading takes only 15-20 sec.

The Merton Overloaders used at Birkenhead were supplied by the sole concessionaires in the United Kingdom, Mackay Industrial Equipment Ltd., and sold and serviced by Knutsford Motors Ltd., Knutsford, Cheshire.

New All-Purpose Tug

Trials recently carried out in London Docks have called attention to the efficient performance of the Voith Water Tractor. The design of this new tug is unique in that the propelling unit is forward and the towing position aft, thus giving stable equilibrium between propeller thrust and tow line, and avoiding any heeling moment on the tractor. This eliminates the necessity for a large lateral hull plane essential for the stability of a normal tug. The dimensions of this all-purpose tug are consequently small and governed primarily by the propeller and engine weights.

Due to the small lateral plane, any change of thrust direction from the propeller—which can be applied with a strength irrespective of the vessel's speed—will move the tractor almost instantaneously in the required direction, thereby giving maximum pull. Any tendency by the tow to swing is checked before it gains momentum: alternatively, maximum force is given immediately to the tow upon change of course. The power needed is therefore less than with the normal tug used for the same purpose.

Voith Water Tractor in London Docks.

Service results have already proved the high standing pull and control of the tow—whether of a single ship or a train of barges.

The vessel is of simple welded construction which, together with the small dimensions, gives lower first cost than for screw tugs of comparable power. Operating costs are lower due to the small size of the tug and the fact that only one man is needed to control it. A further advantage resulting from the variable pitch of the propeller is that the uni-rotational diesel engine, which has a constant speed, operates well under all towing conditions without overload.

The tractor is manufactured in Germany, the English agent being Messrs. E. C. Goldsworthy of Weybridge, Surrey.

Manufacturers' Announcements—continued

Plastic Roofing Sheets

Two plastic corrugated sheets known as Saropane and Sarolite are made from thermo-setting resins reinforced with glass fibre. "Saropane," which is reinforced with a "chopped strand mat"—short lengths of glass-fibre random-laid—is suitable for most purposes. It is produced in two thicknesses, one with a nominal thickness of 1/16-in., and the other with a nominal thickness of 3/64-in. The glass-fibre reinforcement in the latter is scarcely noticeable, with the result that the sheet is almost transparent and the light diffusion low. "Sarolite," containing a woven glass-fibre cloth which provides maximum light diffusion and strength, appears to be only moderately translucent, but in fact transmits approximately the same amount of visible light as Saropane. The nominal sheet thickness is 1/16-in. Both materials are stronger than steel, weight for weight, and have the special property of diffusing the light that passes through, thus throwing an even shadowless light of high intensity—78 per cent. transmission, as compared with 80 per cent. for ¼-in. wire rough-cast glass.

The new plastic has high impact strength and a low noise level; it is resistant to corrosion, and also has the advantage of being easy to repair in the event of damage.

Glass-reinforced plastics can be used for the manufacture of small boats, and for piping to carry petrol, oils and even certain chemicals. But their main use is in the building industry where they are being established as an extremely economical method of admitting light.

Aluminium Landing Craft

An all-aluminium landing craft or Ramped Cargo Lighter, as the commercial user knows it, has been constructed by Head Wrightson Aluminium Ltd. to the order of the Fairmile Construction Co. Ltd., Cobham, Surrey, for service in North Borneo.

The lighter, which is designed to carry a load of 30 tons on a 4-ft. 2-in. draught, is 60-ft. long with a beam of 16-ft., and by using aluminium, its weight has been kept to a minimum, being about 11 tons which is approximately one half that of the steel version used in World War II. The vessel has twin screws and is

powered by two 75 h.p. Perkins Diesel engines. The ramp in the bows allows it to be used for either beach or ramp discharge. A hand-operated winch lowers and raises the ramp, which, when lowered, permits vehicles to be driven on and off the vessel.

Whilst the lighter is designed, primarily, as "flat-bottomed," there is sufficient "tumble-in" to necessitate the development of hull plating and chines. The craft has rivetted joints throughout, and the aluminium alloy, specifically BB 3, was specially chosen for its strong resistance to sea water corrosion. Maintenance costs will, therefore, be kept to a minimum.

New "Pyrene" Fire Tender

The Pyrene Company, Ltd., manufacturers of fire-fighting equipment, have received a contract for a new type of "Pyrene" Foam Tender. It is claimed that the increased speed of operation and fire-fighting efficiency of these tenders represents an important advance in fire protection. Each tender comes into action the moment it reaches the scene of the fire, and is capable of producing 6,000 gallons of fire-fighting foam in 1½ minutes.

Fork Lift Truck for Long Loads

Early this month, Messrs. Ransomes and Rapier Ltd Ipswich demonstrated their latest product, the Rapier Super Fo Truck which has been evolved as the result of an entirely new conception of the mechanical handling of long loads such as timber, steel sections, pipes etc. The machine follows the general pattern of an ordinary fork truck but with the mast arranged to swivel to one side thus enabling the load to be carried in line with the direction of travel of the truck.

The new appliance can, therefore, pick up its load in the manner of an ordinary fork truck and with a combined steering and slewing manœuvre withdraw from the line of sets so that it finishes with the load, on one side, thus presenting a minimum width of only 8-ft. for travelling and manœuvring.

The slewing mast arrangement on the truck has the advantage over any other form of side handling machine that it can pick up set after set lying one behind the other. In other words it can enter a transverse lane between sets, pick up a load at the end, back out with it into the main gangway and manœuvre into its normal travelling position.

The machine has a lifting and carrying capacity of 12,000 lbs. at 24-in. from the face of the forks, and has a turning circle of only 12-ft. 3-in. when carrying a load 21-ft. long and 4-ft. square.

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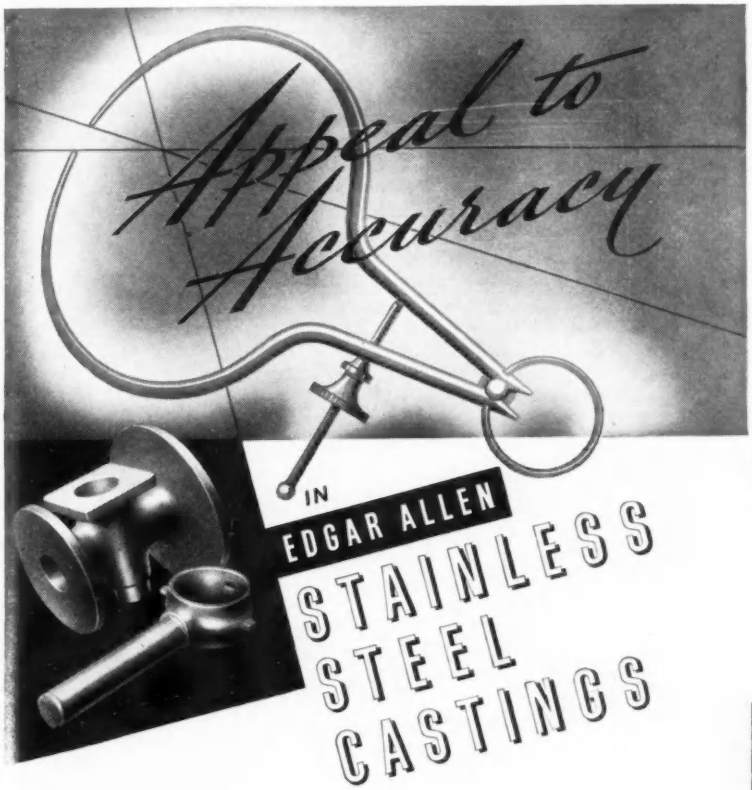

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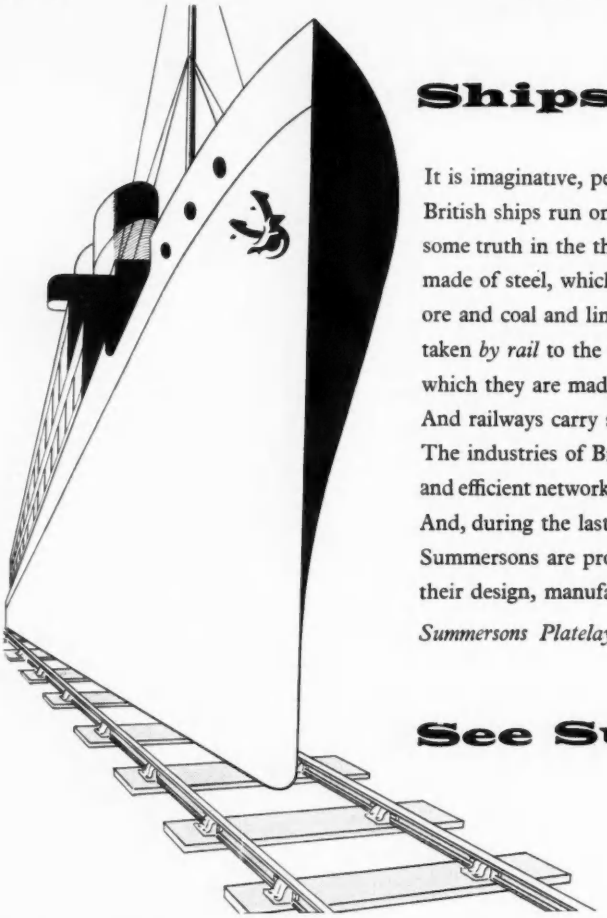

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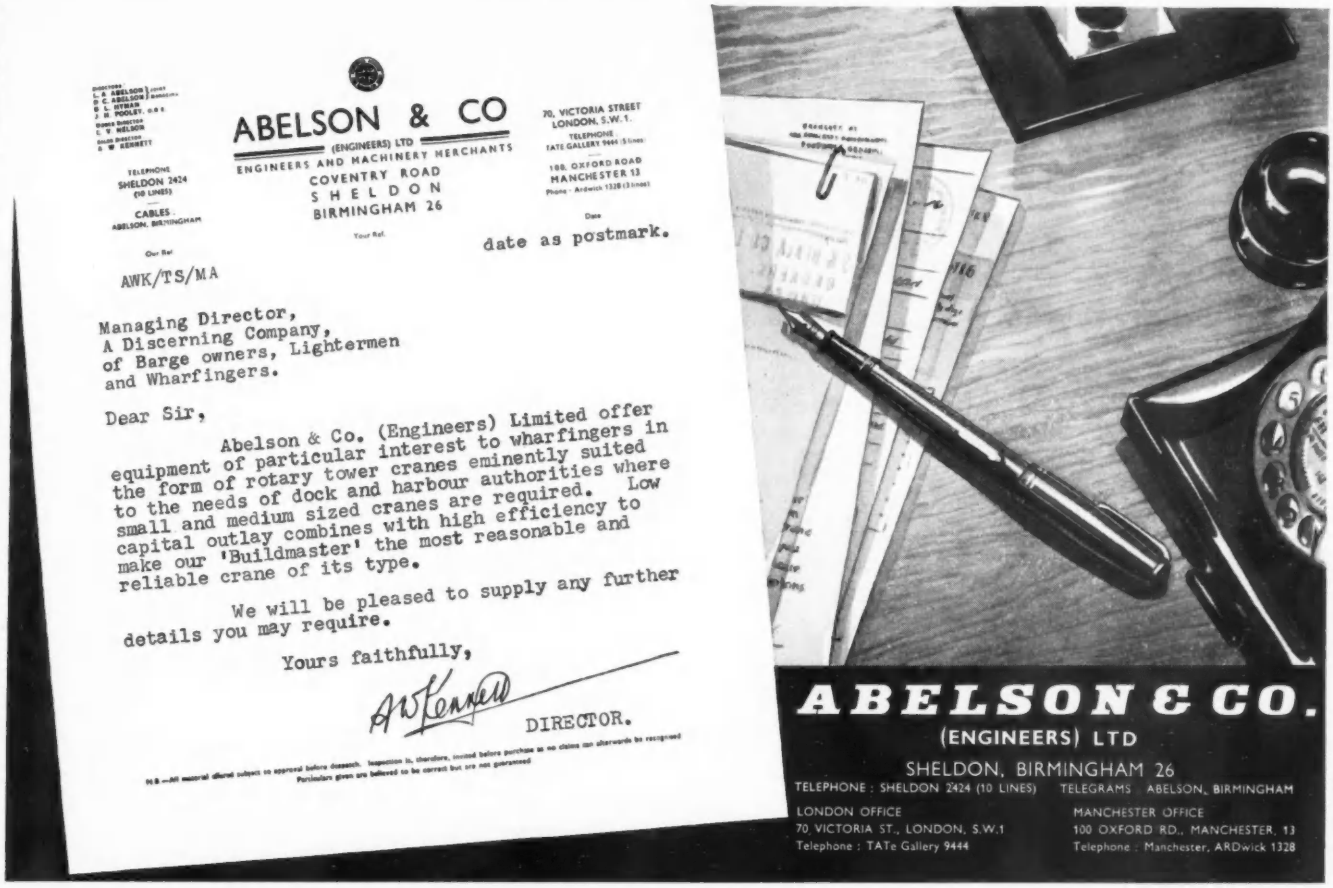
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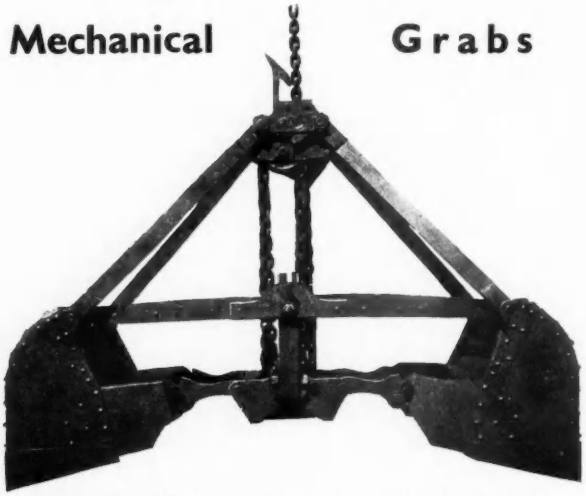

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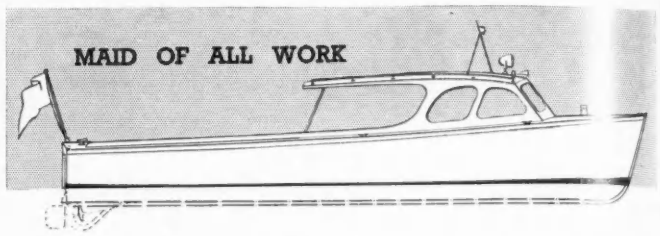

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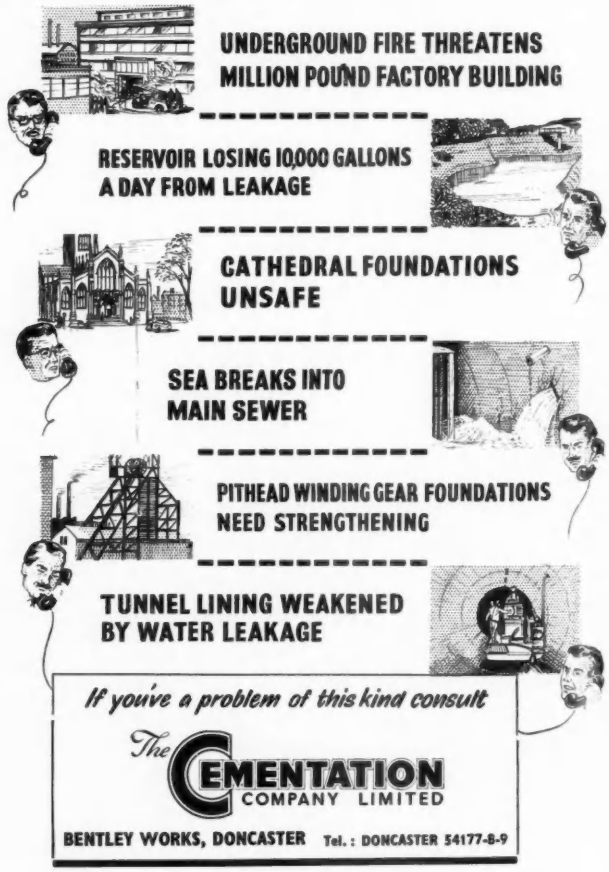
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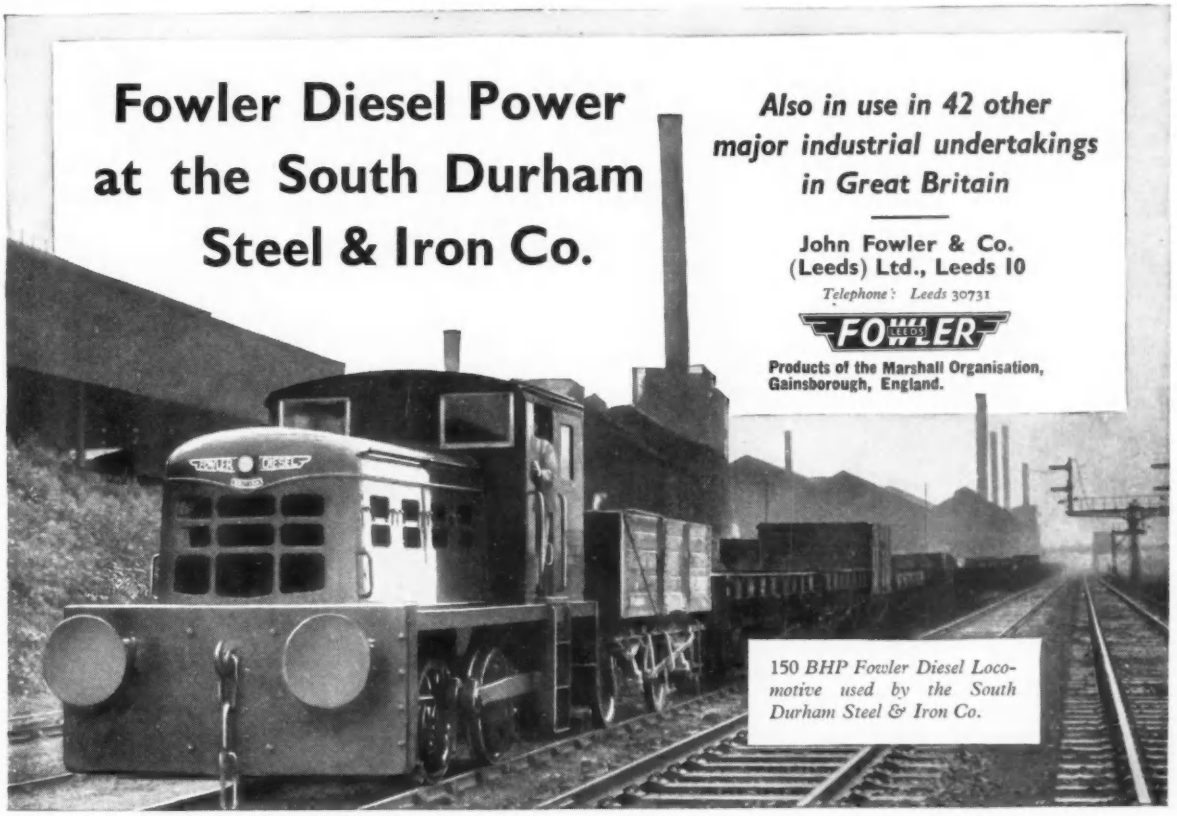

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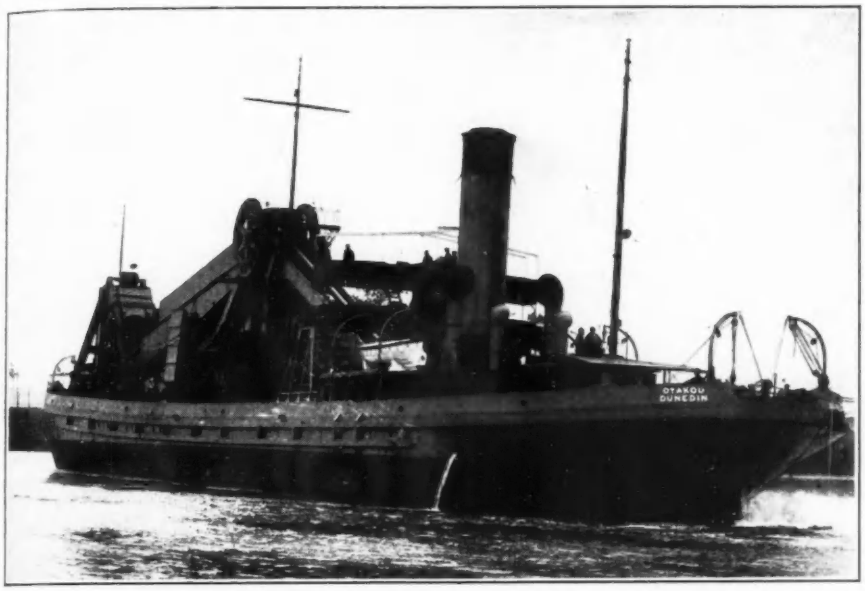

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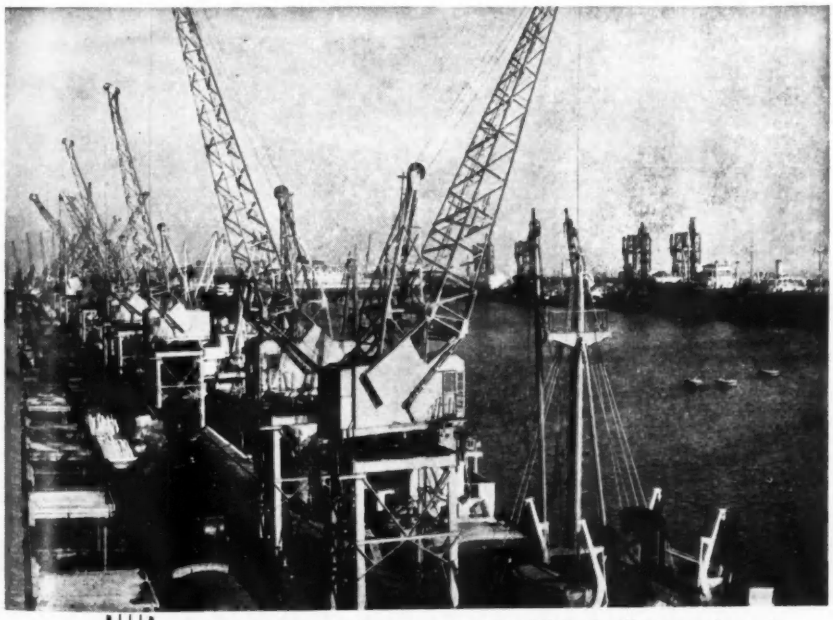

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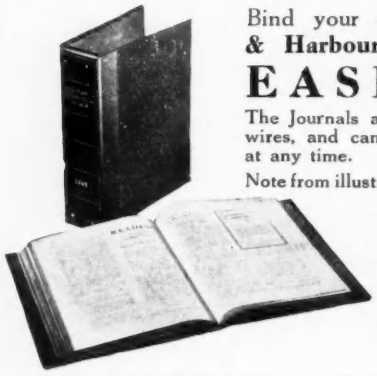

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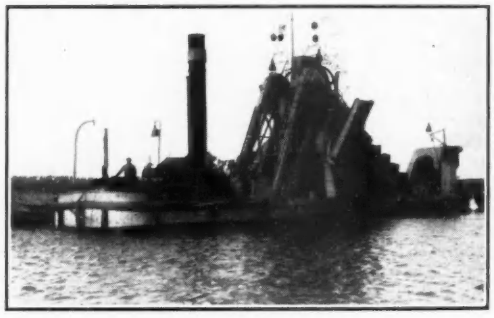

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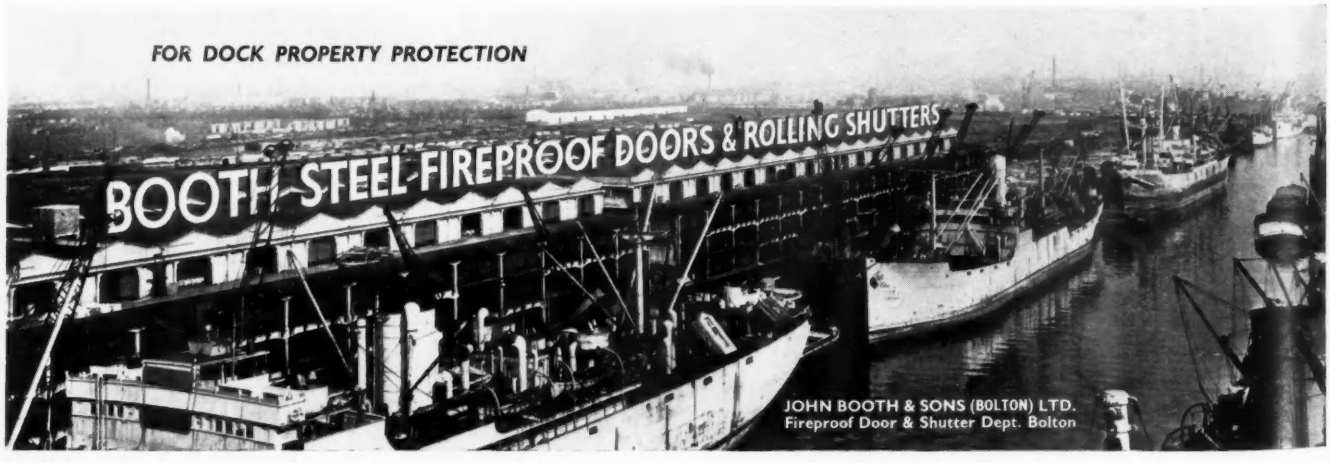
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